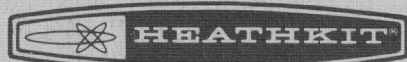


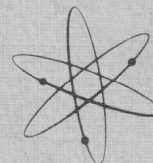
MODEL **GC-1092D Digital**
Time-Calendar Clock
HEATHKIT®
ASSEMBLY MANUAL

MODEL GC-1092D Digital Time-Calendar Clock

HEATH COMPANY • BENTON HARBOR, MICHIGAN



PRICE \$2.00



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595-1708

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

If we determine a defective part has caused your Heathkit electronic product to need other repair, through no fault of yours, we will service it free — at the factory, at any retail Heathkit Electronic Center, or through any of our authorized overseas distributors.

This protection is exclusively yours as the original purchaser. Naturally, it doesn't cover damage by use of acid-core solder, incorrect assembly, misuse, fire, flood or acts of God. But, it does insure the performance of your Heathkit electronic product anywhere in the world — for most any other reason.

After-Warranty Service

What happens after warranty? We won't let you down. If your Heathkit electronic product needs repairs or you need a part, just write or call the factory, your nearest retail Heathkit Electronic Center, or any Heath authorized overseas distributor. We maintain an inventory of replacement parts for each Heathkit model at most locations — even for many models that no longer appear in our current product line-up. Repair service and technical consultation are available through all locations.

We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Started January 11, 1975

Completed January 20, 1975

Assembly
and
Operation
of the



DIGITAL
TIME-CALENDAR
CLOCK

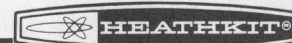
MODEL GC-1092 D



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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022



INTRODUCTION

The Heathkit Model GC-1092D Digital Time-Calendar Clock is a deluxe electronic clock with many attractive features. It alternately displays the time and the date in the Clock's normal sequence of operation. The date can be displayed for five seconds when you touch the "Heathkit" plate on top of the Clock, or a rear panel switch allows you to have the time displayed continuously.

During a power line failure, batteries (not included in the kit) power the internal reference oscillator and the time-keeping integrated circuit. Then, when the power line becomes active again, the correct time will be displayed.

Another feature is the automatic control of the display brightness. This provides a bright display in brightly lit areas

and a dim display at night or in dimly lit areas. This function can be switched out so the display is always bright.

A rear panel switch lets your Clock display either 12-hour or 24-hour time. The Clock "knows" the difference between AM and PM so the date display changes at midnight.

Attractive modern styling; removable, tilting pedestal base; and solid-state dependability make this Clock ideally suited for your office, home, or almost anywhere.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

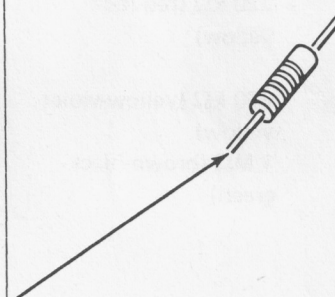
Check each part against the following list. Make a check (✓) in the space provided as you identify each part. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual.

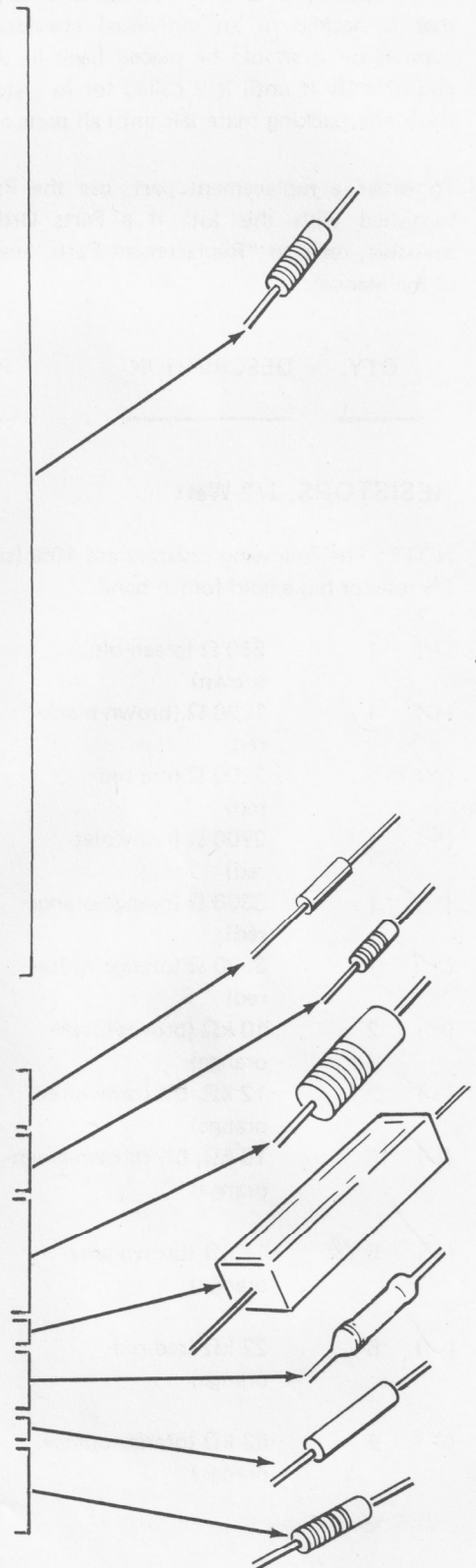
Each circuit part in this kit has its own component number (R2, C4, etc.). Use these numbers when you want to positively identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the parts list,
- At the beginning of each step where a component is installed,
- In some illustrations,
- In the Schematic,
- In the sections at the rear of the Manual.

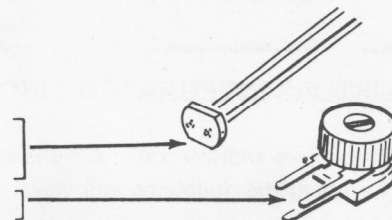
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
RESISTORS, 1/2-Watt				
(✓) 1	560 Ω (green-blue-brown)	1-119	R207	.10
(✓) 1	1000 Ω (brown-black-red)	1-9	R113	.10
(✓) 2	2200 Ω (red-red-red)	1-44	R101, R212	.10
(✓) 1	2700 Ω (red-violet-red)	1-13	R204	.10
(✓) 1	3300 Ω (orange-orange-red)	1-14	R209, R256	.10
(✓) 1	3900 Ω (orange-white-red)	1-46	R218	.10
(✓) 2	10 k Ω (brown-black-orange)	1-20	R205, R211	.10
(✓) 2	12 k Ω , 5% (brown-red-orange)	1-109	R126, R219	.20
(✓) 6	15 k Ω , 5% (brown-green-orange)	1-133	R117, R119, R122, R124, R128, R131	.10
(✓) 5	18 k Ω (brown-gray-orange)	1-69	R107, R112, R115, R217, R215	.10
(✓) 6	22 k Ω (red-red-orange)	1-22	R224, R228, R233, R237, R242, R246	.10
(✓) 9	33 k Ω (orange-orange-orange)	1-24	R105, R106, R116, R118, R121, R123, R125, R127, R129	.10



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
Resistors (cont'd.)				
(✓) 1	39 k Ω (orange-white-orange)	1-67	R213	.10
(✓) 2	47 k Ω (yellow-violet-orange)	1-25	R114, R216	.10
(✓) 1	56 k Ω (green-blue-orange)	1-47	R206	.10
(✓) 1	82 k Ω (gray-red-orange)	1-102	R222	.10
(✓) 24	100 k Ω (brown-black-yellow)	1-26	R109, R132, R133, R134, R135, R136, R137, R214, R223, R225, R227, R229, R232, R234, R236, R238, R241, R243, R245, R247, R250, R254, R255, R262 R221	.10
(✓) 1	120 k Ω (brown-red-yellow)	1-121	R249, R257, R253, R261,	.10
(✓) 4	180 k Ω (brown-gray-yellow)	1-126	R226, R231, R235, R239, R244, R248,	.10
(✓) 6	220 k Ω (red-red-yellow)	1-29	R108	.10
(✓) 1	470 k Ω (yellow-violet-yellow)	1-33	R111, R240	.10
(✓) 2	1 M Ω (brown-black-green)	1-35		
Other				
(✓) 1	1130 Ω , 1% (1.13 k), 1/4-watt	2-57-12	R209	.25
(✓) 1	10 M Ω , 1/4-watt (brown-black-blue)	1-88-12		.10
(✓) 1	150 Ω , 1-watt (brown-green-brown)	1-18-1	R202	.10
(✓) 1	680 Ω , 1-watt (blue-gray-brown)	1-21-1	R203	.10
(✓) 1	4700 Ω , (4.7 k) 7-watt	3-21-7	R201	.15
(✓) 1	24 k Ω , 1%	2-268	R208	.20
(✓) 1	180 k Ω , 1%	2-8-11	R102	.25
(✓) 1	1 M Ω , 1%	2-96-12	R104	.25
(✓) 6	100 M Ω , 20% (brown-black-violet)	1-139	R138, R139, R141, R142, R143, R144	.20

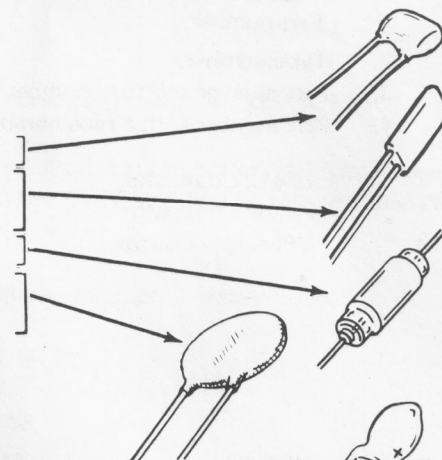


QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
Other (cont'd.)				
(✓) 1	LDR (light-dependent resistor)	9-67	LDR101	.90
(✓) 1	470 k Ω control	10-985	R103	.10



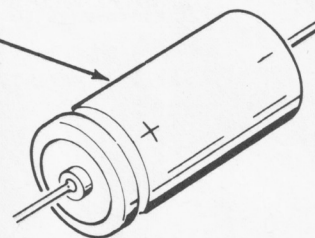
CAPACITORS

(✓) 1	50 pF mica	20-97	C208	.15
(✓) 1	2700 pF (.0027k) Mylar*	27-141	C204	.10
(✓) 2	.01 μ F Mylar	27-74	C205, C209	.10
(✓) 1	.01 μ F polystyrene	29-2	C101	.15
(✓) 1	.005 μ F disc	21-27	C102	.10
(✓) 1	.02 μ F disc	21-31	C202	.10
(✓) 5	10 μ F tantalum	25-220	C103, C104, C105, C206, C207	.45
(✓) 1	20 μ F electrolytic	25-16	C201	.75
(✓) 1	1200 μ F electrolytic	25-241	C203	.90

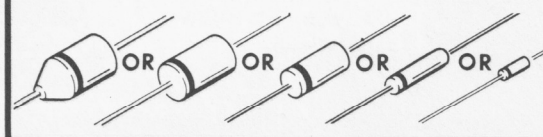


DIODES

(✓) 1	VR-16.1G zener	56-36	D209	1.50
(✓) 19	1N4149	56-56	D214, D215, D216, D217, D218, D219, D221, D222, D223, D224, D226, D227, D228, D229, D231, D232, D233, D234, D235	.20
(✓) 1	1N716A zener (violet-brown-blue)	56-57	D213	.65
(✓) 3	ZVR-68 zener	56-68	D204, D205, D206	1.50
(✓) 3	1N2071	57-27	D201, D202, D203	.50
(✓) 4	1N4002	57-65	D207, D208, D211, D212	.20



NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES.



*DuPont Registered Trademark.

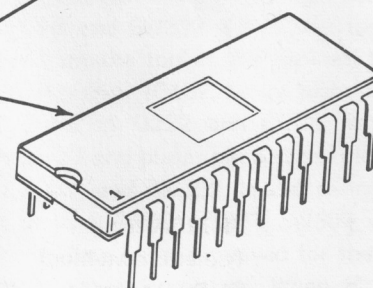
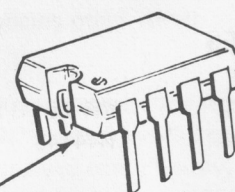
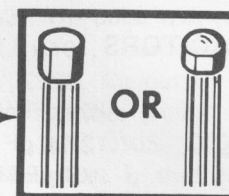
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
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TRANSISTORS-INTEGRATED CIRCUITS

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

(✓) 2	2N4121 transistor	417-235	Q205, Q223	.60
(✓) 1	2N3643 transistor	417-233	Q203	.50
(✓) 13	MPSA42 transistor	417-294	Q105, Q106, Q107, Q108, Q109, Q111, Q112, Q208, Q211, Q213, Q215, Q217, Q219	.60
(✓) 6	MPSL51 transistor	417-295	Q209, Q212, Q214, Q216, Q218, Q221	.50
(✓) 12	MPSA20 transistor	417-801	Q101, Q102, Q103, Q104, Q201, Q202, Q204, Q206, Q207, Q222, Q225, Q226	.20
(✓) 2	NE555V integrated circuit	442-53	IC101, IC102	1.75
(✓) 1	MK5017BA integrated circuit	443-637	IC201	15.25



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
SWITCHES-INSULATORS				
(✓) 2	SPDT switch	60-4	SW305, SW308	.20
(✓) 2	SPST switch	60-6	SW303, SW304	.30
(✓) 3	DPDT switch	60-2	SW301, SW302, SW307	.30
(✓) 1	4PDT switch	60-29	SW306	.80

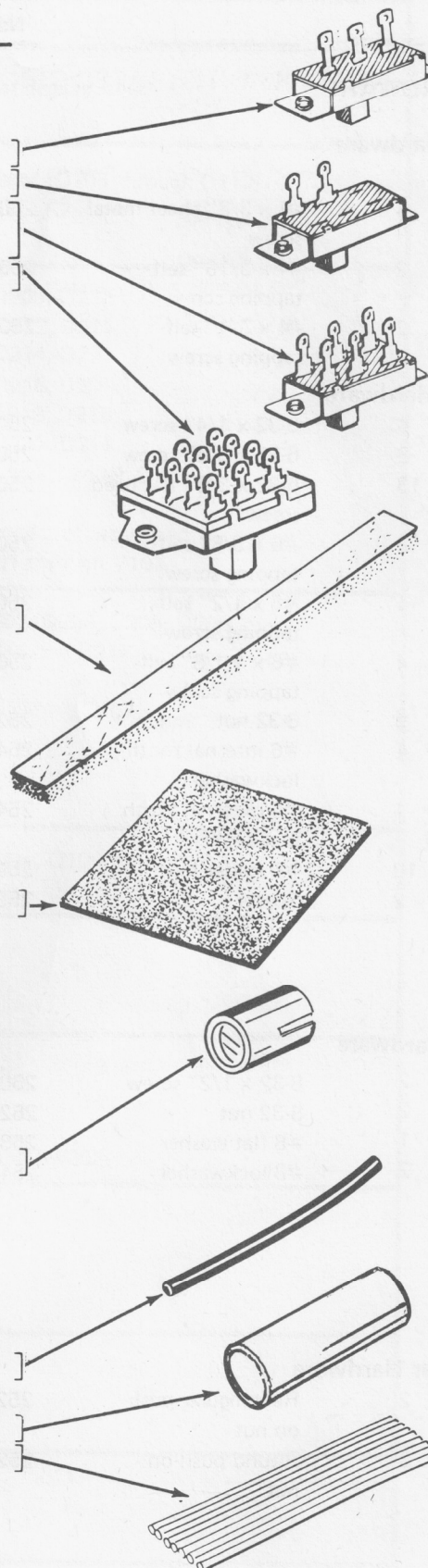
(✓) 1 Foam tape 73-92 .15

(✓) 1 Fish paper 75-108 .10

(✓) 1 LDR shield 266-857 *

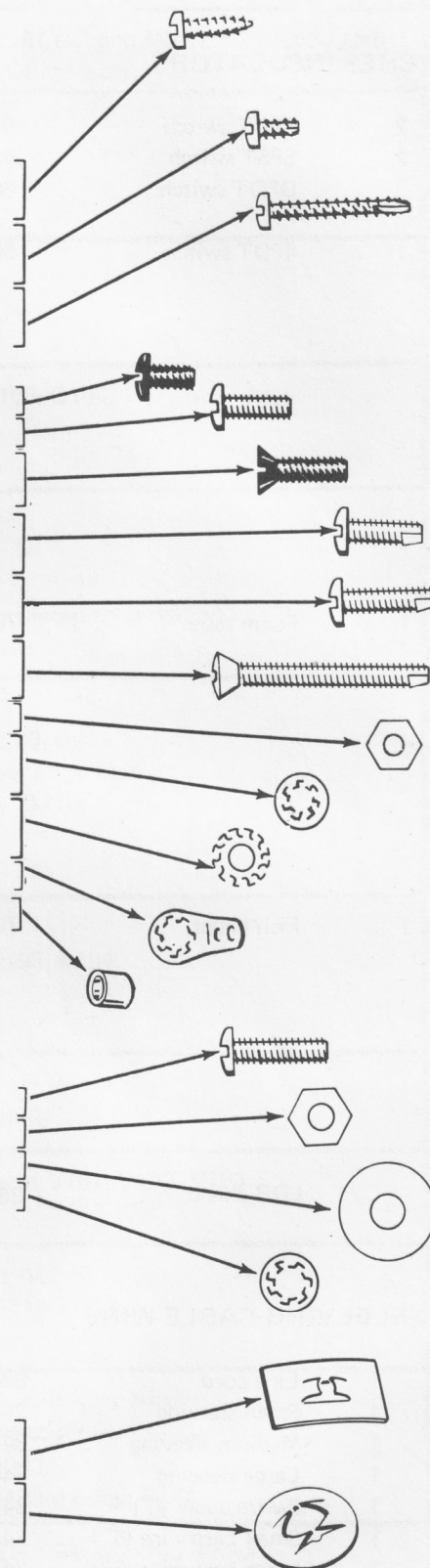
CORD-SLEEVING-CABLE-WIRE

(✓) 1 Line cord 89-44 .55
 (✓) 1 Small sleeving 346-1 .05
 (✓) 1 Medium sleeving 346-20 .05
 (✓) 1 Large sleeving 346-60 .05
 (✓) 1 8-wire cable (8') 347-55 .25
 (✓) 1 Small bare wire (6'') 340-8 .05
 (✓) 1 Large bare wire (6'') 340-11 .05



*Write to the Heath Company for Price Information.

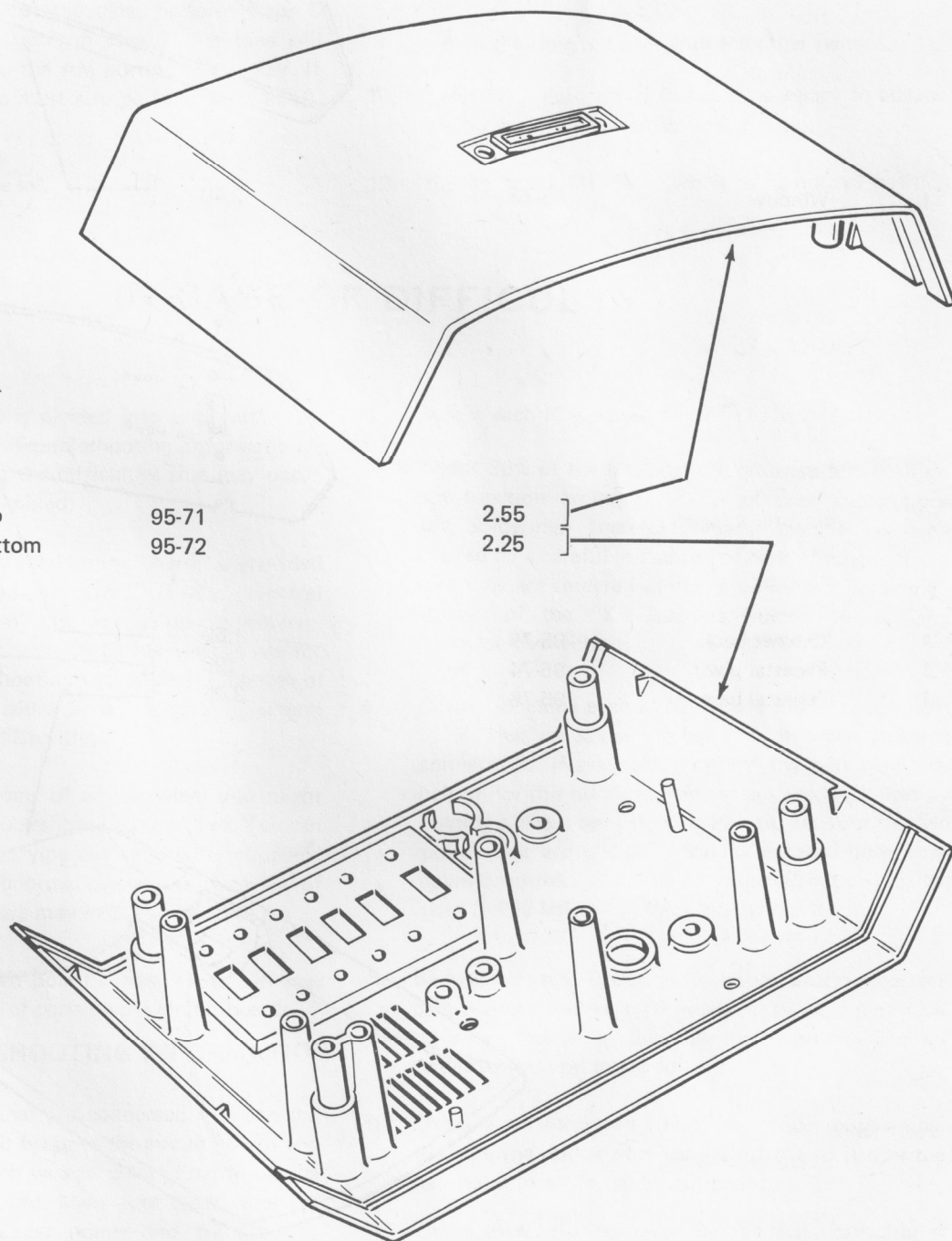
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
HARDWARE				
#4 Hardware				
(✓) 4	#4 x 3/8" sheet metal screw	250-186		.05
(✓) 2	#4 x 3/16" self-tapping screw	250-489		.15
(✓) 2	#4 x 3/4" self-tapping screw	250-477		.05
#6 Hardware				
(✓) 4	6-32 x 1/4" screw	250-452		.05
(✓) 2	6-32 x 3/8" screw	250-89		.05
(✓) 13	6-32 x 3/8" flat head screw	250-276		.05
(✓) 2	#6 x 3/8" self-tapping screw	250-592		.05
(✓) 1	#6 x 1/2" self-tapping screw	250-591		.05
(✓) 4	#6 x 1-1/8" self-tapping screw	250-1137		.10
(✓) 5	6-32 nut	252-3		.05
(✓) 4	#6 internal tooth lockwasher	254-1		.05
(✓) 1	#6 external tooth lockwasher	254-6		.05
(✓) 10	#6 solder lug	259-1		.05
(✓) 2	Spacer	255-73		.05
#8 Hardware				
(✓) 2	8-32 x 1/2" screw	250-585		.10
(✓) 2	8-32 nut	252-4		.05
(✓) 1	#8 flat washer	253-9		.05
(✓) 2	#8 lockwasher	254-2		.05
Other Hardware				
(✓) 2	Rectangular push-on nut	252-10		.05
(✓) 2	Round push-on nut	252-116		.05



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
(✓) 1	Main circuit board	85-1429-2		2.20
(✓) 1	Display circuit board	85-1430-1		1.60

CIRCUIT BOARDS-CABINET-LABELS

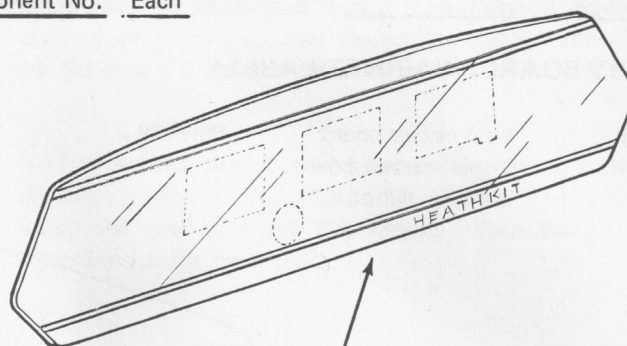
(✓) 1	Cabinet top	95-71	2.55
(✓) 1	Cabinet bottom	95-72	2.25



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
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Circuit Boards-Cabinet-Labels (cont'd.)

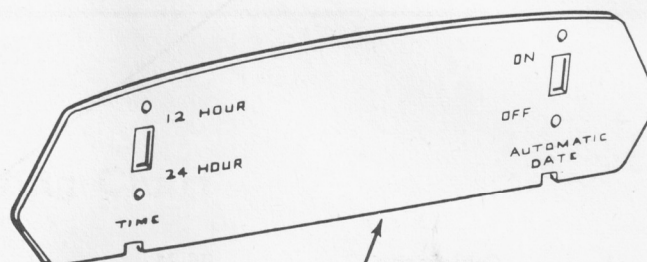
(✓) 1	Window	95-73		
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2.40

}

(✓) 1	Cabinet back	95-75		
(✓) 1	Pedestal pivot	95-74		
(✓) 1	Pedestal base	95-76		



1.60

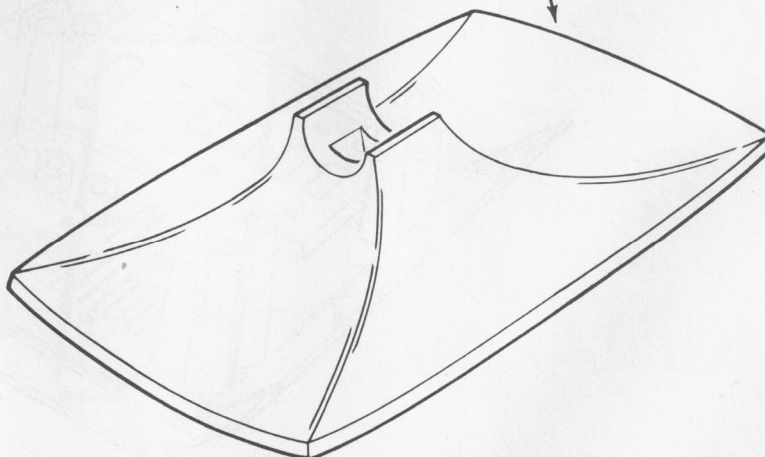
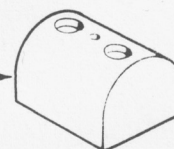
.90

2.05

}

}

}



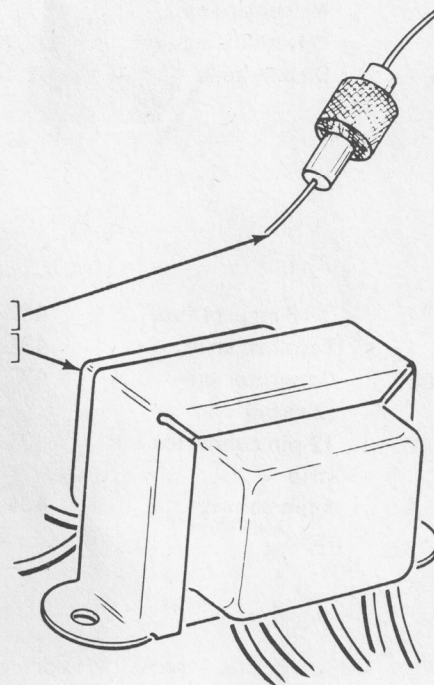
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
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Circuit Boards-Cabinet-Labels (cont'd.)

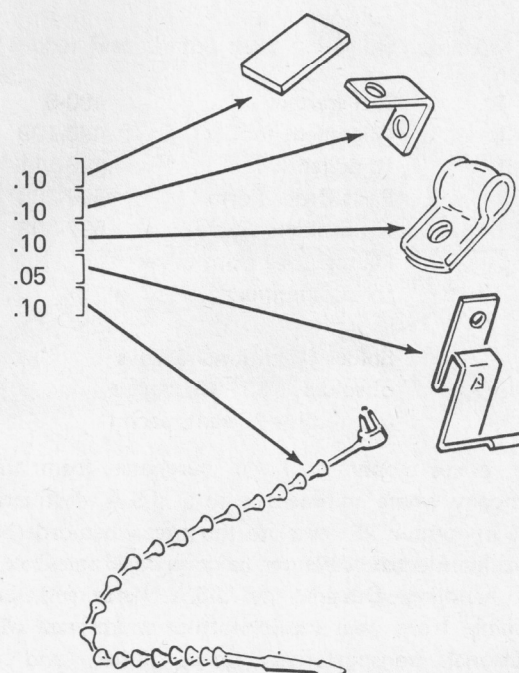
(✓) 1	Fuse replacement label	390-362		.10
(✓) 1	Switch labels (1 set)	390-1061		.15
(✓) 1	Blue and white label	391-34		

MISCELLANEOUS

(✓) 1	2 mH coil	45-84	L201	.45
(✓) 1	Power transformer	54-859	T301	5.00



(✓) 8	Rubber foot	75-138		
(✓) 2	Angle bracket	204-102		
(✓) 1	Cable clamp	207-5		
(✓) 6	Battery clip	260-83		
(✓) 2	Cable tie	354-6		



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
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Miscellaneous (cont'd.)

(✓)	1	Nameplate base	391-89	V101, V102, V103
(✓)	1	"Heathkit" insert	391-90	
(✓)	3	Display tube	411-295	

1.90
1.35
5.00

(✓)	1	3/16-ampere fuse	421-40	F301
(✓)	1	Terminal strip	431-96	
(✓)	65	Connector pin (2 extra)	432-134	
(✓)	2	12-pin connector strip	434-263 *	
(✓)	4	4-pin connector strip	434-264 *	

.40
.10
.10

(✓)	1	Nut starter	490-5	
(✓)	1	Alignment tool	490-109	
(✓)	1	IC puller	490-111	
(✓)	1	Parts Order Form	597-260	
(✓)	1	Kit Builders Guide	597-308	
(✓)		Manual (See front cover for part number.)		

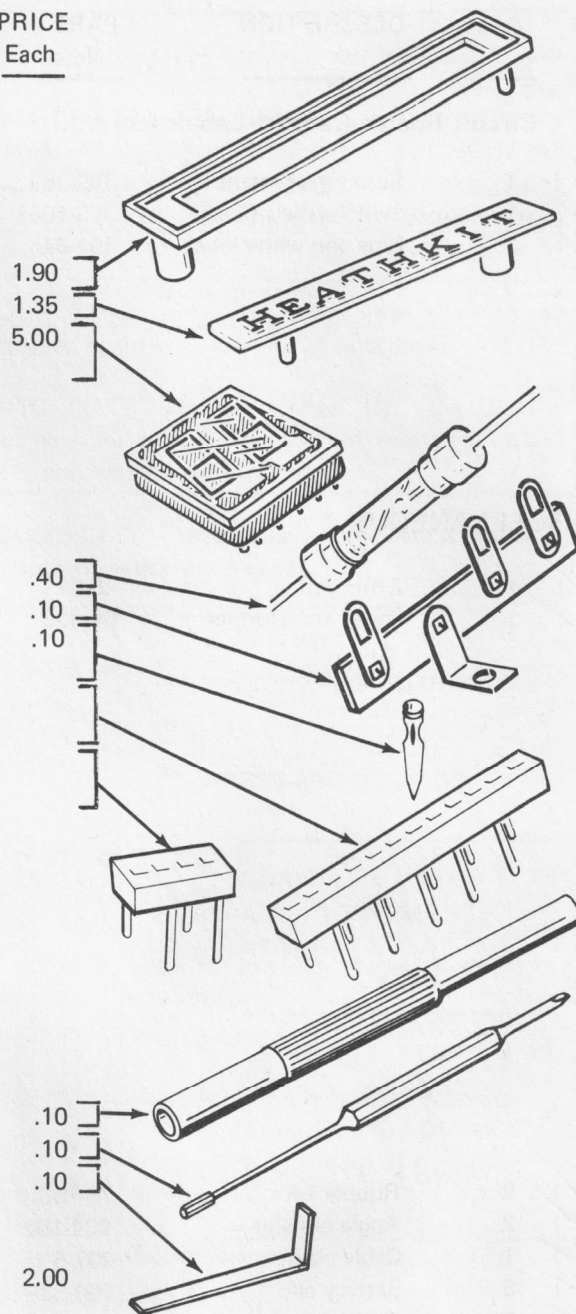
.10
.10
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2.00

(✓) Solder (Additional 6' rolls
of solder, #331-13, can be
ordered for 25 cents each.)

The prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

*Write to the Heath Company for Price Information.



You should purchase three AA penlite cells at this time for use in your kit. Representative manufacturers and their type numbers are:

BATTERY	TYPE	VOLTAGE	LIFE EXPECTANCY IN CLOCK	APPROXIMATE DISCHARGE TIME	APPROXIMATE CHARGING TIME
Eveready CH500	Nickel-cadmium	1.2	Several years	6 hours	28 hours
Neda 15M	Mercuric-dioxide	1.4	Longer than 12 months	18 hours	Non-rechargeable
Neda 15A	Alkaline-manganese- dioxide	1.5	12 months	10 hours	Non-rechargeable
Neda 15	Zinc-carbon	1.5	6 months	3.5 hours	Non-rechargeable

NOTE: Your clock will work without batteries when the line cord is plugged into an AC power outlet. However, having batteries in your Clock will allow it to continue to keep time if you unplug the Clock to relocate it or if the AC power fails (due to storms, etc.).

STEP-BY-STEP ASSEMBLY

ASSEMBLY NOTES

- Before you start to assemble this kit, read the wiring, soldering, and step-by-step assembly information in the "Kit Builders Guide."
- Due to the small foil area around the circuit board holes and the small areas between foils, it will be necessary to use the utmost care to prevent solder bridges between adjacent foil areas. Use only a minimum amount of solder and use no larger than a 50-watt soldering iron with a small tip. Allow it to reach operating temperature, and then apply it only long enough to make a good solder connection.
- If a small wattage, small-tip soldering iron is not available, proceed as follows: Be sure your soldering iron is cool. Wrap the large bare wire (supplied) tightly around the soldering iron tip as shown in Figure 1. Allow approximately 1/4" of wire to extend beyond the end of the soldering iron. Cut the wire end to a chisel shape as shown. Occasionally apply solder to the turns of large bare wire to achieve a good heat transfer.

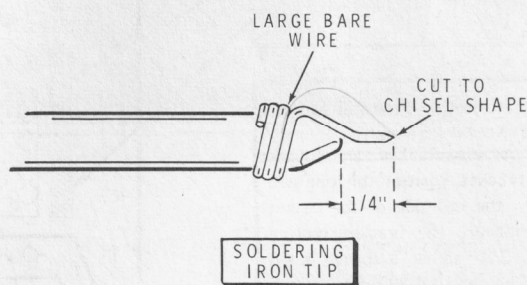


Figure 1

- Resistors will be called out by their resistance value in Ω , $k\Omega$, or $M\Omega$, and color code.
- Capacitors will be called out by their capacitance value (in pF or μF) and type (disc, mica, Mylar, or electrolytic).

SAFETY WARNING: Avoid eye injury when you clip off excess leads. We suggest that you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.

FOR GOOD SOLDER CONNECTIONS, YOU MUST
KEEP THE SOLDERING
IRON TIP CLEAN.

WIPE IT OFTEN
WITH A DAMP
SPONGE OR CLOTH.



CIRCUIT BOARDS

START

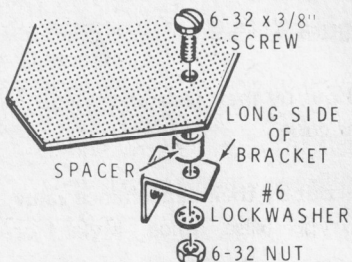
Position the display circuit board as shown. Then complete each step on the Pictorial.

Install seven 100 k Ω resistors (brown-black-yellow) as follows:

- (✓) R132.
- (✓) R133.
- (✓) R109.
- (✓) R134.
- (✓) R135.
- (✓) R136.
- (✓) R137.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) Angle bracket. Position the long side next to the foil side of the circuit board. Secure the bracket with a 6-32 x 3/8" screw, a spacer, a #6 lockwasher, and a 6-32 nut.



CONTINUE

(✓) Angle bracket. Install it as before. Use a 6-32 x 3/8" screw, a spacer, a #6 lockwasher, and a 6-32 nut.

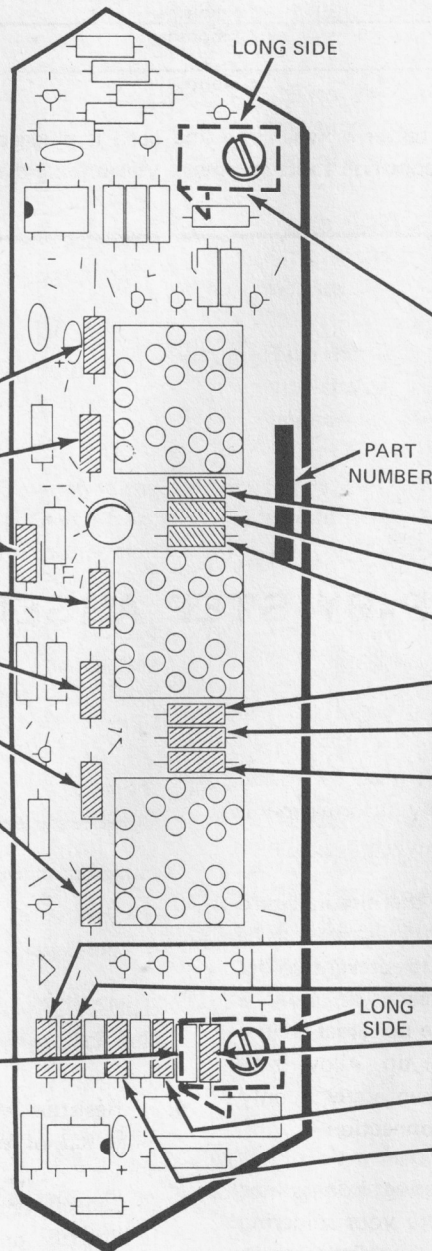
Install six 100 M Ω resistors (brown-black-violet) as follows:

- (✓) R138.
- (✓) R139.
- (✓) R141.
- (✓) R142.
- (✓) R143.
- (✓) R144.

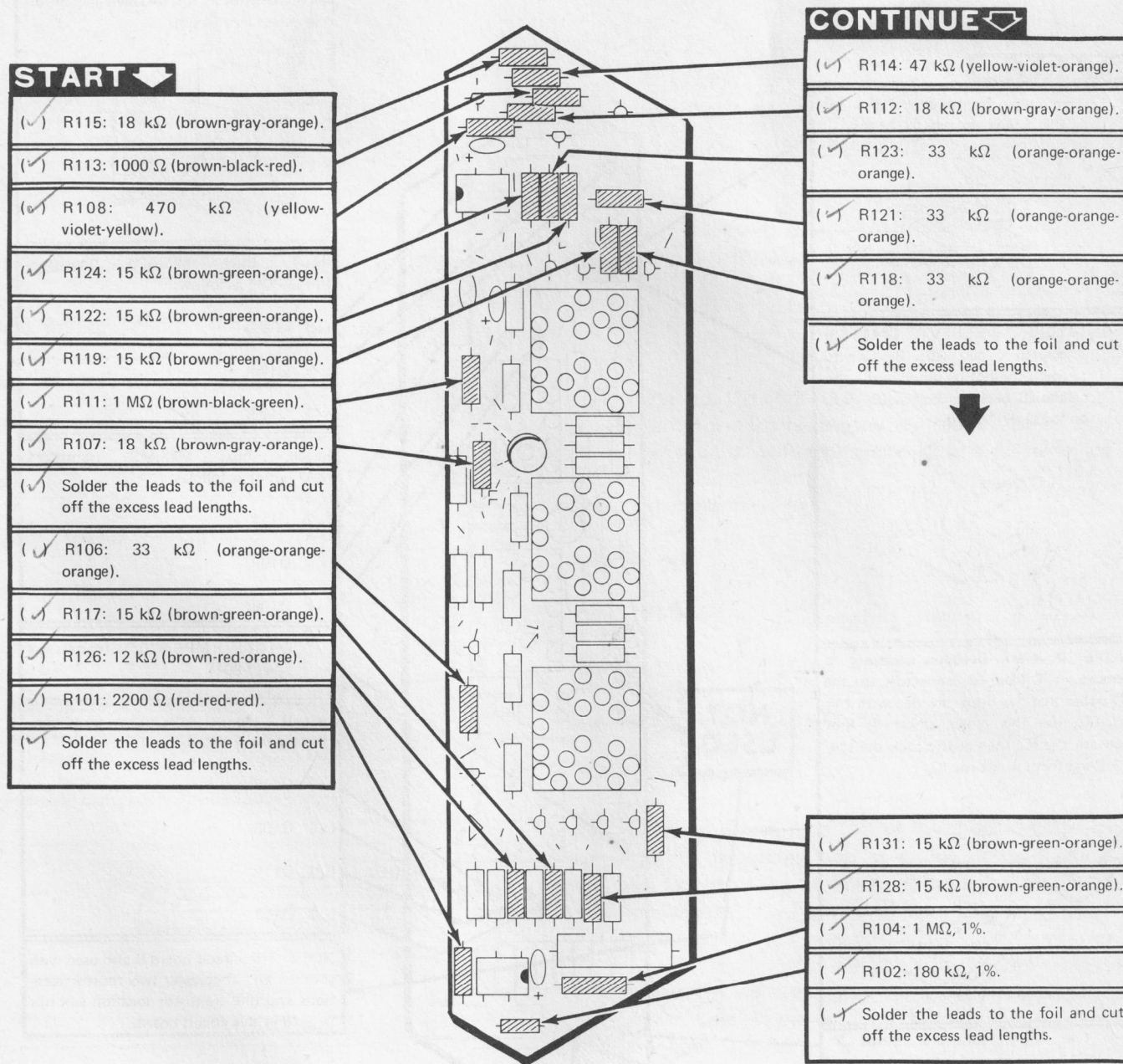
Install five 33 k Ω resistors (orange-orange-orange) as follows:

- (✓) R105.
- (✓) R125.
- (✓) R129.
- (✓) R127.
- (✓) R116.

(✓) Solder the leads to the foil and cut off the excess lead lengths.



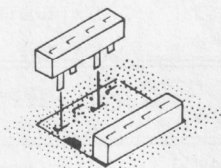
PICTORIAL 1-1



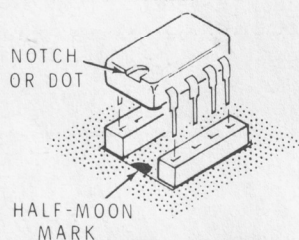
PICTORIAL 1-2

START →

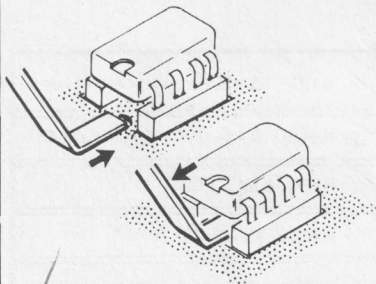
- (✓) Two 4-pin connector strips at IC102. Solder the pins to the foil.



- (✓) IC102: NE555V (#442-53) integrated circuit (IC). Be sure to position the dot or notch in the end of the IC over the half-moon mark on the circuit board.



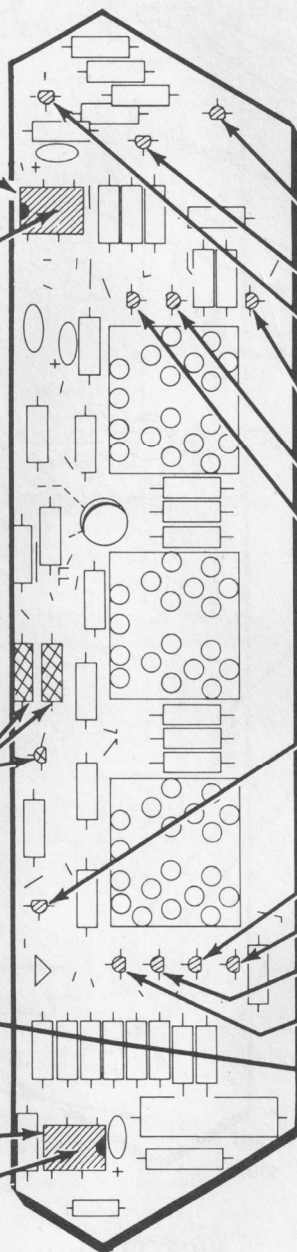
NOTE: If it ever becomes necessary to remove an IC from its connectors, use the IC puller that has been included with this kit. To use this puller, insert its foot beneath the IC; then gently rock the tool back and forth to lift the IC.



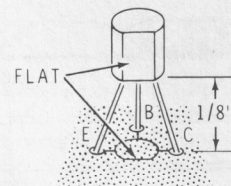
- (✓) Two 4-pin connector strips at IC101.

- (✓) IC101: NE555V (#442-53) integrated circuit. Install this IC the same as before. Note the position of the half-moon mark on the circuit board.

NOT USED

**CONTINUE** →

NOTE: When you install a transistor, line up the flat on the transistor with the flat on the circuit board and insert the transistor leads into the corresponding E, B, and C holes in the circuit board. Solder each transistor as it is installed and cut off the excess lead lengths.



Install three MPSA20 transistors (#417-801) as follows:

- (✓) Q104.
(✓) Q102.
(✓) Q103.

Install three MPSA42 transistors (#417-294) as follows:

- (✓) Q111.
(✓) Q109.
(✓) Q108.

(✓) Q101: MPSA20 transistor (#417-801).

Install four MPSA42 transistors (#417-294) as follows:

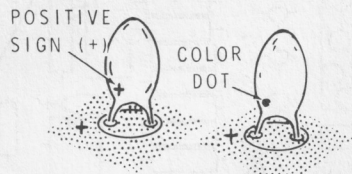
- (✓) Q106.
(✓) Q105.
(✓) Q112.
(✓) Q107.

NOTE: This circuit board is also used with another kit. Therefore, two resistor locations and one transistor location will not be used in this circuit board.

PICTORIAL 1-3

START

NOTE: When you install a tantalum capacitor, always match the positive (+) or dot marked side of the capacitor with the positive (+) mark on the circuit board.

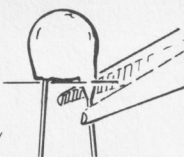


(✓) C103: 10 μ F tantalum.

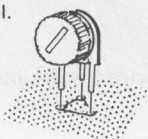
(✓) C104: 10 μ F tantalum.

(✓) C102: .005 μ F disc. Remove any excess coating from the leads. Use long-nose pliers to remove the coating.

REMOVE COATING
EVEN WITH
BOTTOM OF
CAPACITOR BODY



(✓) R103: 470 k Ω control. Solder the lugs to the foil.

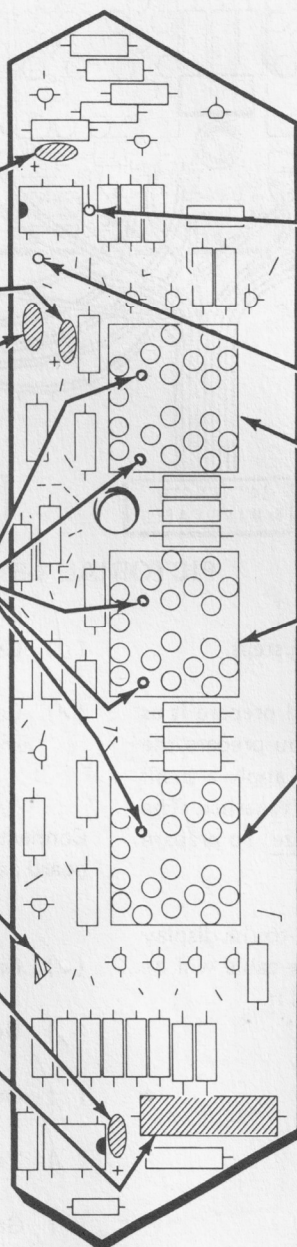


(✓) C105: 10 μ F tantalum.

(✓) C101: .01 μ F polystyrene (#29-2). Disregard the red end.

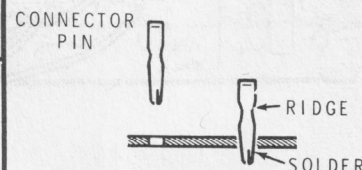
(✓) Solder the leads to the foil and cut off the excess lead lengths.

NOT
USED



CONTINUE

(✓) Connector pin at FA. Solder the pin to the foil.



(✓) Connector pin at FB. Solder the pin to the foil.

(✓) Eighteen connector pins at V101. Solder the pins to the foil. Be sure the pins are straight and even.

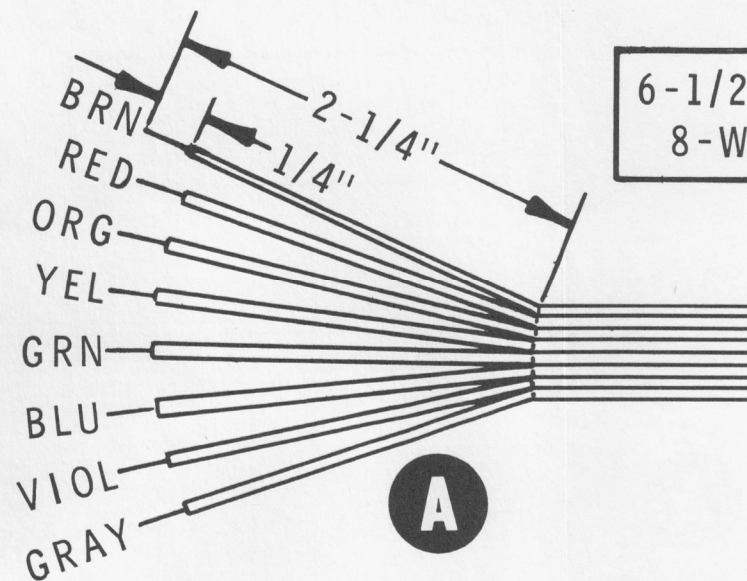
(✓) Eighteen connector pins at V102. Solder the pins to the foil. Be sure the pins are straight and even.

(✓) Nineteen connector pins at V103. Solder the pins to the foil. Be sure the pins are straight and even.

PICTORIAL 1-4

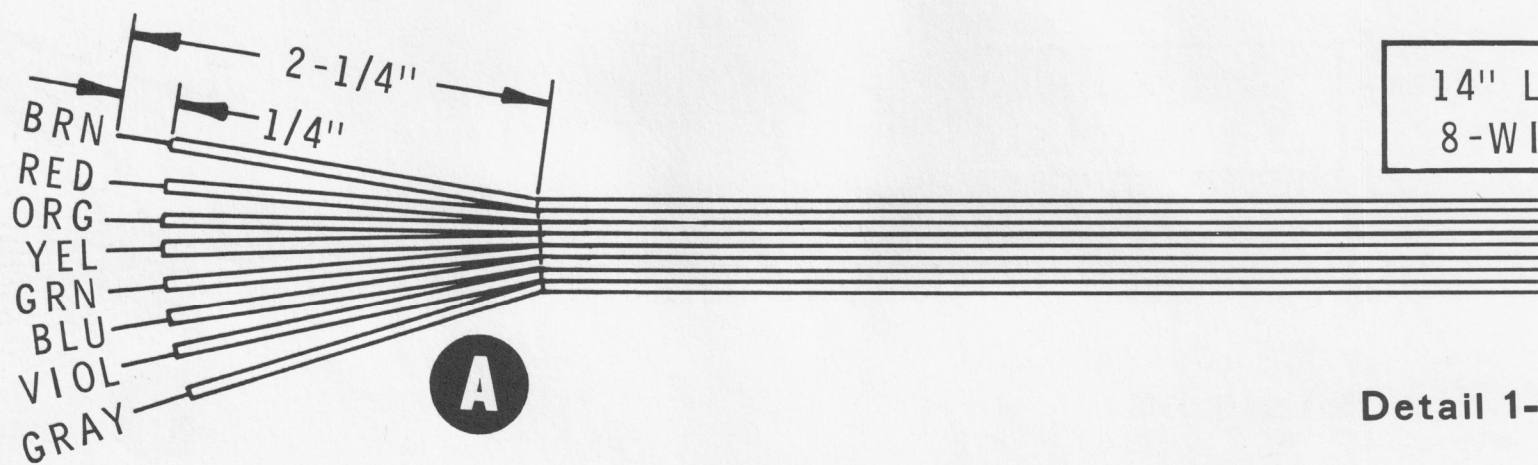
ACTUAL
SIZE
DRAWINGS

SEPARATE THE WIRES AS
1/4" OF INSULATION F



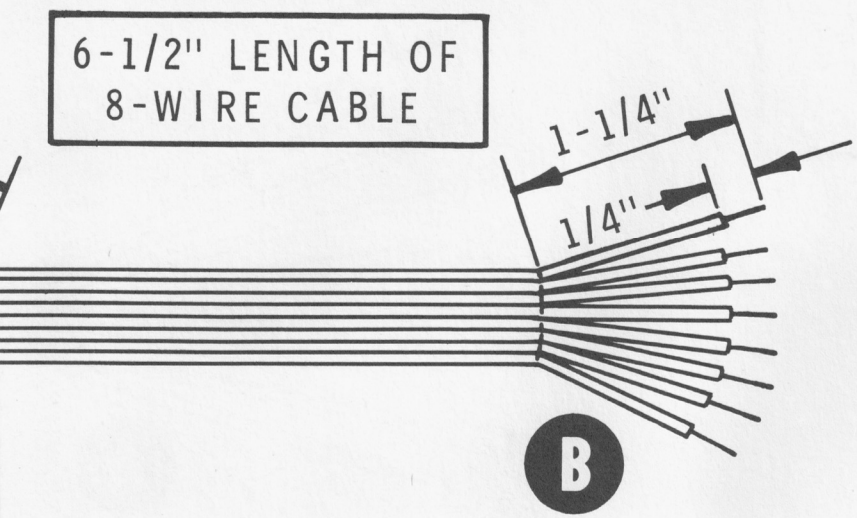
Detail

SEPARATE THE WIR
REMOVE 1/4" INSULATION



Detail 1-

WIRES AS SHOWN AND REMOVE
INSULATION FROM EACH WIRE END



Detail 1-5A

WIRES AS SHOWN AND
REMOVE INSULATION FROM EACH WIRE END

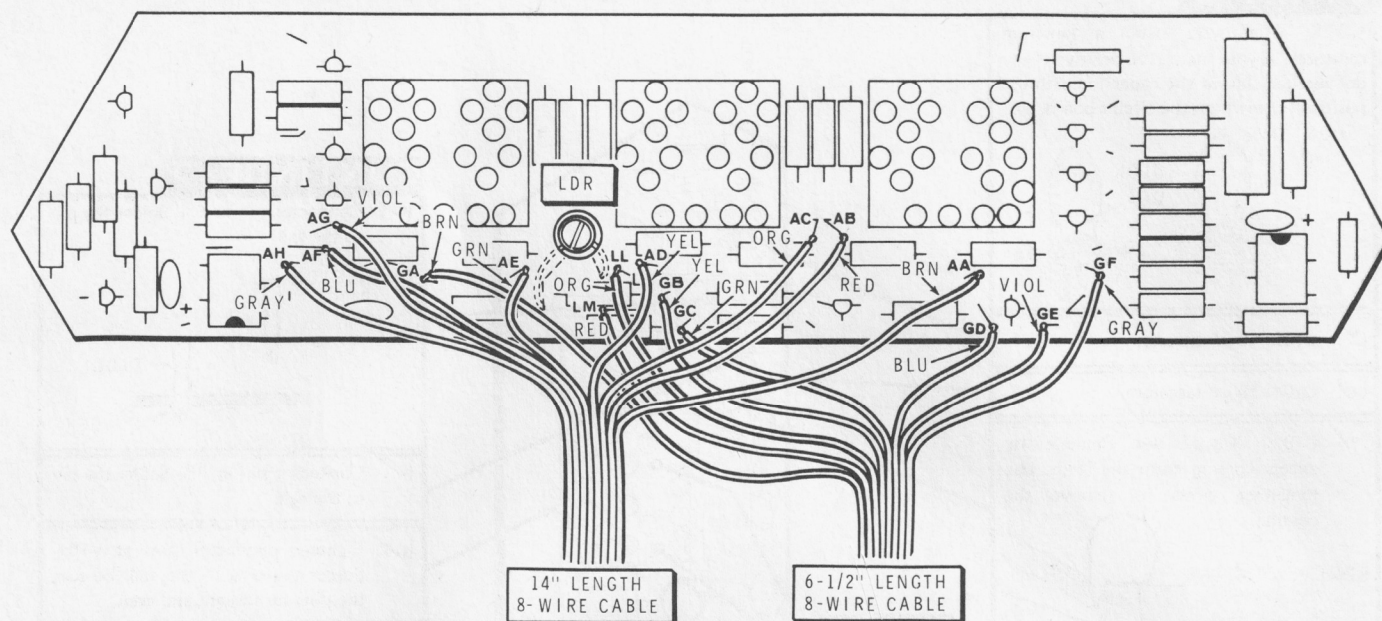


Detail 1-5B



Refer
(✓)

Con
circu
conn
(✓)
(✓)
(✓)
(✓)
(✓)
(✓)
(✓)
(✓)



PICTORIAL 1-5

Refer to Pictorial 1-5 (above) for the following steps.

- (✓) Cut a 6-1/2" length of 8-wire cable and prepare it as shown in Detail 1-5A. NOTE: When you prepare the stranded wires, twist the bare ends and apply a small amount of solder to hold the strands together. The cables in the Details are shown actual size. To prepare a cable, position it over the Detail.

Connect the wires at end A of the 8-wire cable to the display circuit board as follows: The free end of the cable will be connected later. Solder each wire as you install it.

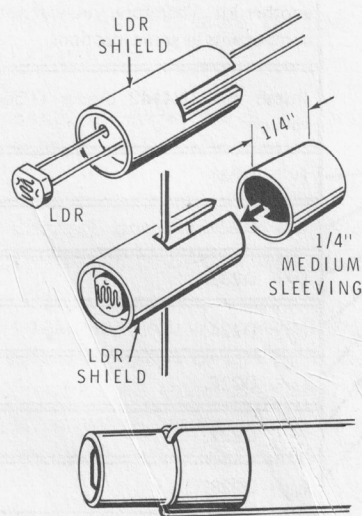
- (✓) Brown to hole GA.
- (✓) Red to hole LM.
- (✓) Orange to hole LL.
- (✓) Yellow to hole GB.
- (✓) Green to hole GC.
- (✓) Blue to hole GD.
- (✓) Violet to hole GE. NOTE: The letters GE are covered by the nearby control.

- (✓) Gray to hole GF.

- (✓) Cut a 14" length of 8-wire cable and prepare it as shown in Detail 1-5B.

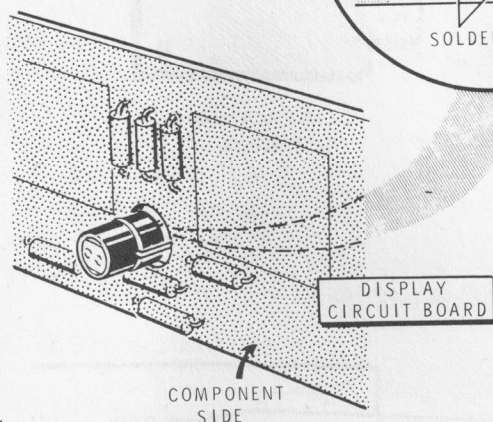
Connect end A of the 8-wire cable to the display circuit board as follows: Solder each wire as you install it.

- (✓) Brown to hole AA.
- (✓) Red to hole AB.
- (✓) Orange to hole AC.
- (✓) Yellow to hole AD.
- (✓) Green to hole AE.
- (✓) Blue to hole AF.
- (✓) Violet to hole AG.
- (✓) Gray to hole AH.

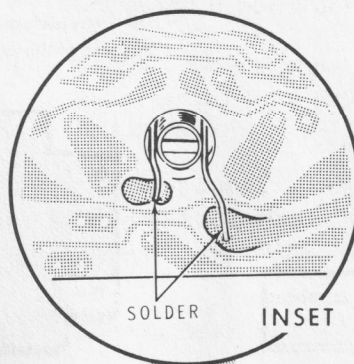


Detail 1-5C

- (✓) Refer to Detail 1-5C and slide the LDR into the LDR shield.
- (✓) Bend the LDR leads out as shown. Then cut a 1/4" length of medium sleeving, slide it over the LDR shield as shown, and bend the leads back over the sleeving as shown.
- (✓) Refer to Detail 1-5D and bend the LDR leads to fit into the holes as shown in the inset drawing. Then insert the leads into their holes and the LDR into its hole. The rear of the LDR shield should be flush with the component side of the circuit board.* Solder the leads to the foil and cut off the excess lead lengths.



Detail 1-5D

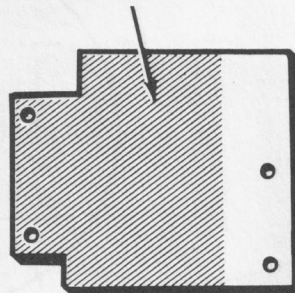


CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections. NOTE: Component locations R145, R146, and Q113 are not used in this kit.
- (✓) "Cold" solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Transistors for the proper type and installation.
- (✓) Tantalum capacitor for the correct position of the positive (+) end.
- (✓) Set the circuit board aside temporarily.

The steps performed in this Pictorial are in this area of the circuit board.

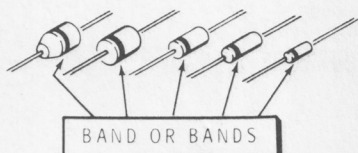


IDENTIFICATION
DRAWING

START

Position the main circuit board as shown in the identification drawing.

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



- (✓) D235: 1N4149 diode (#56-56).
- (✓) D234: 1N4149 diode (#56-56).
- (✓) D209: VR-16.1G diode (#56-36).
- (✓) D203: 1N2071 diode (#57-27).
- (✓) D201: 1N2071 diode (#57-27).
- (✓) D202: 1N2071 diode (#57-27).
- (✓) D207: 1N4002 diode (#57-65).
- (✓) D208: 1N4002 diode (#57-65).
- (✓) D211: 1N4002 diode (#57-65).
- (✓) D212: 1N4002 diode (#57-65).
- (✓) D213: 1N716A diode (#56-57, violet-brown-blue).

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.**

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



- (✓) Solder the leads to the foil and cut off the excess lead lengths.

CONTINUE

NOTE: This circuit board is also used with another kit. Therefore, you will not install components at some locations.

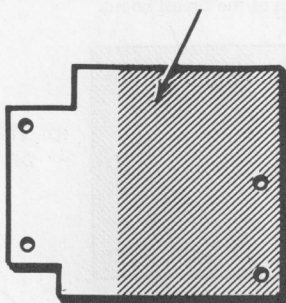
Install ten 1N4149 diodes (#56-56) as follows:

- (✓) D231.
- (✓) D229.
- (✓) D233.
- (✓) D224.
- (✓) D226.
- (✓) D227.
- (✓) D228.
- (✓) D218.
- (✓) D217.
- (✓) D214.

- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-1

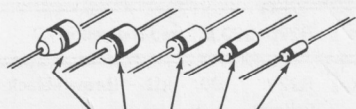
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

START

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.



BAND OR BANDS

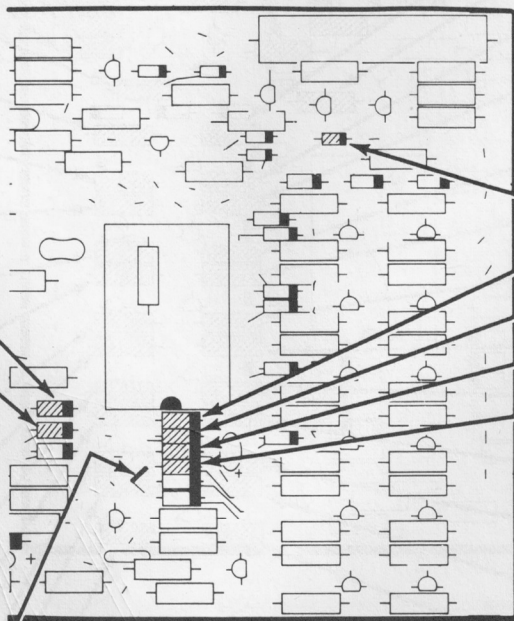
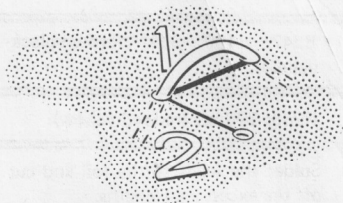
(✓) D215: 1N4149 diode (#56-56).

(✓) D216: 1N4149 diode (#56-56).

NOTE: In the next step, save a cutoff lead for use later.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) Install a cutoff lead at 1. Solder the ends to the foil and cut off the excess lead ends. (There will be nothing installed at position 2.)



CONTINUE

(✓) D232: 1N4149 diode (#56-56).

(✓) D223: 1N4149 diode (#56-56).

(✓) D222: 1N4149 diode (#56-56).

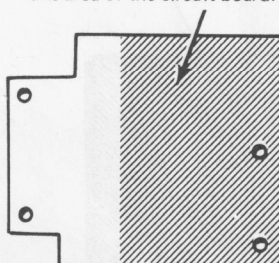
(✓) D221: 1N4149 diode (#56-56).

(✓) D219: 1N4149 diode (#56-56).

(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-2

The steps performed in this Pictorial are in this area of the circuit board.

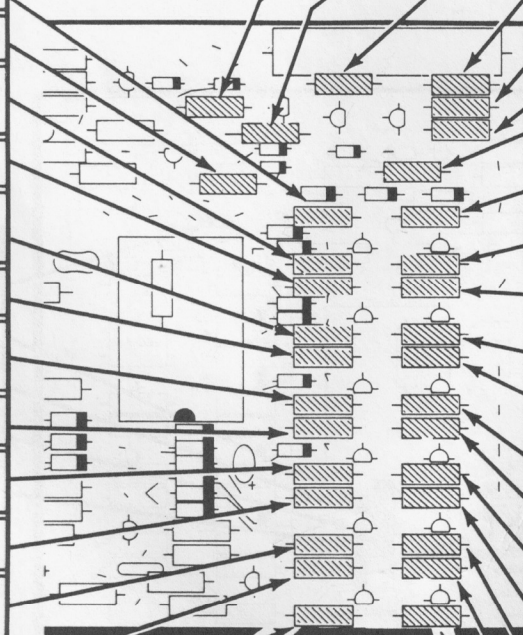


IDENTIFICATION
DRAWING

CONTINUE →

START →

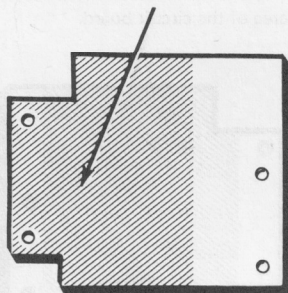
- (✓) R224: 22 k Ω (red-red-orange).
- (✓) R261: 180 k Ω (brown-gray-yellow).
- (✓) R223: 100 k Ω (brown-black-yellow).
- (✓) R228: 22 k Ω (red-red-orange).
- (✓) R227: 100 k Ω (brown-black-yellow).
- (✓) R233: 22 k Ω (red-red-orange).
- (✓) R232: 100 k Ω (brown-black-yellow).
- (✓) R237: 22 k Ω (red-red-orange).
- (✓) R236: 100 k Ω (brown-black-yellow).
- (✓) R242: 22 k Ω (red-red-orange).
- (✓) R241: 100 k Ω (brown-black-yellow).
- (✓) R246: 22 k Ω (red-red-orange).
- (✓) R245: 100 k Ω (brown-black-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



- (✓) R262: 100 k Ω (brown-black-yellow).
- (✓) R253: 180 k Ω (brown-gray-yellow).
- (✓) R254: 100 k Ω (brown-black-yellow).
- (✓) R256: 3300 Ω (orange-orange-red).
- (✓) R255: 100 k Ω (brown-black-yellow).
- (✓) R257: 180 k Ω (brown-gray-yellow).
- (✓) R240: 1 M Ω (brown-black-green).
- (✓) R225: 100 k Ω (brown-black-yellow).
- (✓) R226: 220 k Ω (red-red-yellow).
- (✓) R229: 100 k Ω (brown-black-yellow).
- (✓) R231: 220 k Ω (red-red-yellow).
- (✓) R234: 100 k Ω (brown-black-yellow).
- (✓) R235: 220 k Ω (red-red-yellow).
- (✓) R238: 100 k Ω (brown-black-yellow).
- (✓) R239: 220 k Ω (red-red-yellow).
- (✓) R243: 100 k Ω (brown-black-yellow).
- (✓) R244: 220 k Ω (red-red-yellow).
- (✓) R247: 100 k Ω (brown-black-yellow).
- (✓) R248: 220 k Ω (red-red-yellow).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-3

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

START →

(✓) R208: 24 k Ω , 1%.



(✓) R209: 1130 Ω (1.13 k), 1/4-watt, 1%.

(✓) R217: 18 k Ω (brown-gray-orange).

(✓) R211: 10 k Ω (brown-black-orange).

(✓) R216: 47 k Ω (yellow-violet-orange).

(✓) R214: 100 k Ω (brown-black-yellow).

(✓) R215: 18 k Ω (brown-gray-orange).

(✓) R206: 56 k Ω (green-blue-orange).

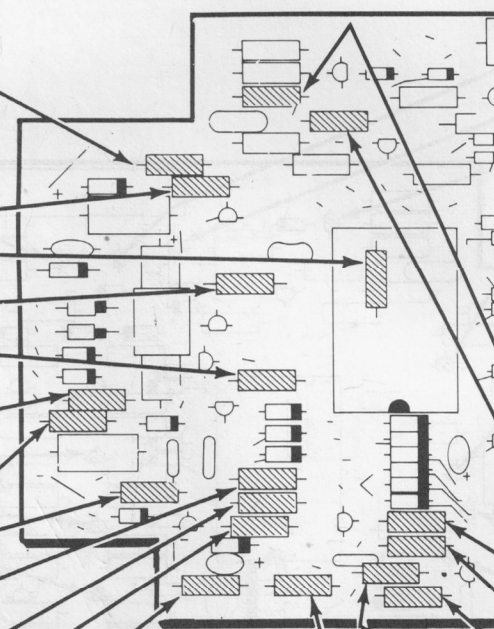
(✓) R205: 10 k Ω (brown-black-orange).

(✓) R207: 560 Ω (green-blue-brown).

(✓) R204: 2700 Ω (red-violet-red).

(✓) R213: 39 k Ω (orange-white-orange).

(✓) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE →

(✓) R249: 180 k Ω (brown-gray-yellow).

(✓) R250: 100 k Ω (brown-black-yellow).

(✓) R221: 120 k Ω (brown-red-yellow).

(✓) R219: 12 k Ω (brown-red-orange).

(✓) R222: 82 k Ω (gray-red-orange).

(✓) R218: 3900 Ω (orange-white-red).

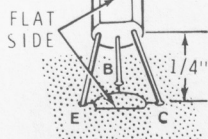
(✓) R212: 2200 Ω (red-red-red).

(✓) Solder the leads to the foil and cut off the excess lead lengths.

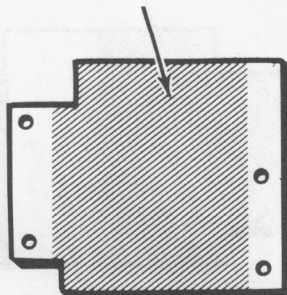
PICTORIAL 2-4

START →

NOTE: When you install a transistor, line up the flat on the transistor with the flat on the circuit board and insert the transistor leads into the corresponding E, B, and C holes in the circuit board. Solder each transistor as it is installed and cut off the excess lead lengths.



The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

Install four MPSA20 transistors (#417-801) as follows:

(✓) Q222.

(✓) Q225.

(✓) Q226.

(✓) Q204.

(✓) Q203: 2N3643 transistor (#417-233).

Install four MPSA20 transistors (#417-801) as follows:

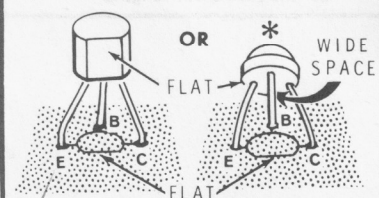
(✓) Q206.

(✓) Q202.

(✓) Q207.

(✓) Q201.

NOTE: The transistor marked with an asterisk must be installed with its wide space opposite to the flat marked on the circuit board.



(✓) Q205: 2N4121 transistor (#417-235).

CONTINUE →

(✓) Q223: 2N4121 transistor (#417-235).

Install six MPSA42 transistors (#417-294) as follows:

(✓) Q208.

(✓) Q211.

(✓) Q213.

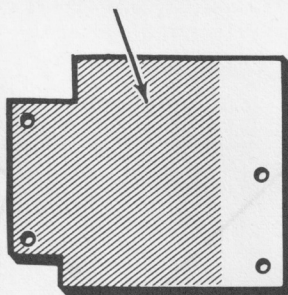
(✓) Q215.

(✓) Q217.

(✓) Q219.

PICTORIAL 2-5

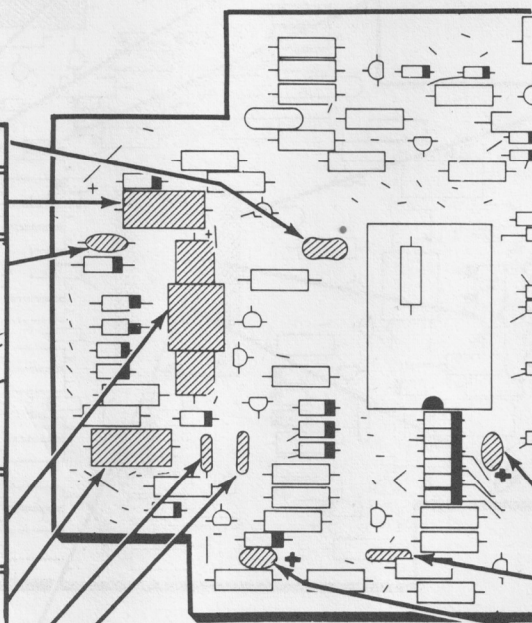
The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION
DRAWING

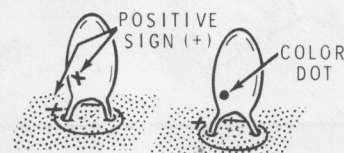
START ▾

- (✓) C208: 50 pF mica.
 - (✓) R202: 150 Ω , 1-watt (brown-green-brown).
 - (✓) C202: .02 μ F disc. Remove any excess coating from the leads.
- REMOVE COATING
EVEN WITH
BOTTOM OF
CAPACITOR BODY
- (✓) L201: 2 mH coil. [Ignore the plus (+) on the circuit board near one end of the coil.]
 - (✓) R203: 680 Ω , 1-watt (blue-gray-brown).
 - (✓) C205: .01 μ F Mylar.
 - (✓) C204: .0027 μ F Mylar.
 - (✓) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE ▾

NOTE: When you install a tantalum capacitor, always match the positive (+) or dot marked side of the capacitor with the positive (+) mark on the circuit board.

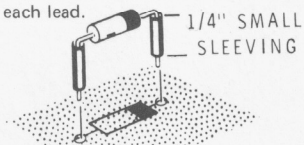


- (✓) C207: 10 μ F tantalum.
- (✓) C209: .01 μ F Mylar.
- (✓) C206: 10 μ F tantalum.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 2-6

START

- (✓) D204: ZVR-68 diode (#56-68). Position the banded end as shown and use 1/4" of small sleeving on each lead.

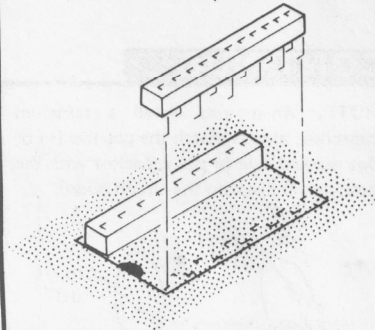


- (✓) D205: ZVR-68 diode (#56-68). Position the banded end as shown and use 1/2" of small sleeving on each lead.

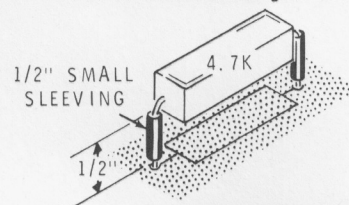
- (✓) D206: ZVR-68 diode (#56-68). Position the banded end as shown and use 1/2" of small sleeving on each lead.

- (✓) Solder the leads to the foil and cut off the excess lead lengths.

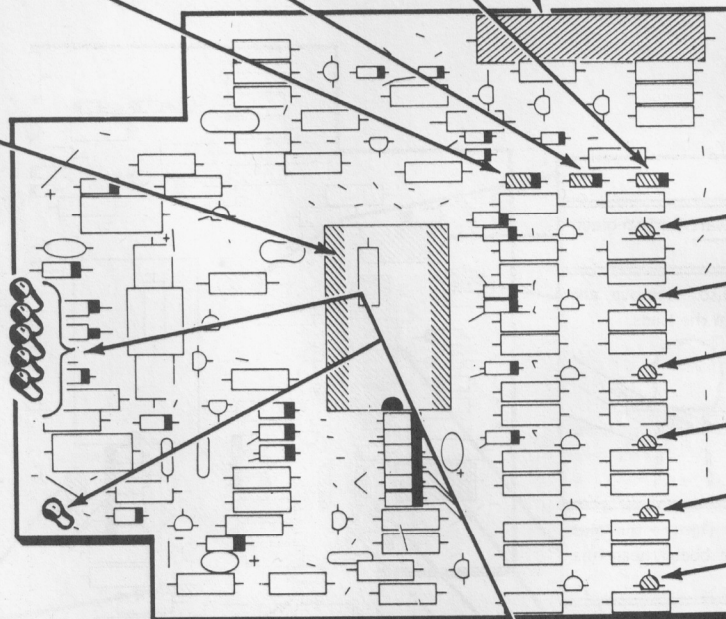
- (✓) Two 12-pin connector strips at IC201. Solder the pins to the foil.

**CONTINUE**

- (✓) R201: 4700 Ω (4.7 k), 7-watt. Use 1/2" length of small sleeving on each lead. Solder the leads to the foil and cut off the excess lead lengths.



Install six MPSL51 transistors (#417-295) as follows: Solder each transistor as it is installed and cut off the excess lead lengths.



(✓) Q209.

(✓) Q212.

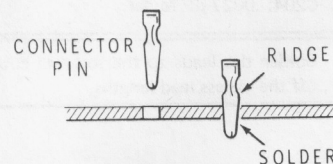
(✓) Q214.

(✓) Q216.

(✓) Q218.

(✓) Q221.

- (✓) Six connector pins at T, U, X, Y, Z, and GND. Solder them to the foil.

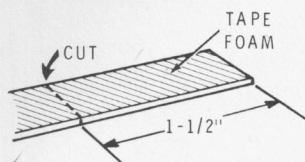


PICTORIAL 2-7

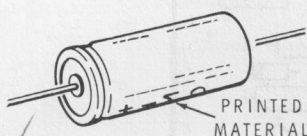
START

(✓) Turn the circuit board over (foil side up) as shown.

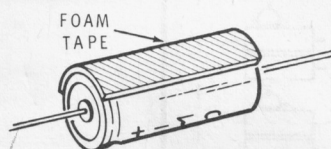
(✓) Cut two 1-1/2" lengths of foam tape.



(✓) Position the 1200 μ F electrolytic capacitor with the printed material facing downward as shown.



(✓) Remove the brown paper from one of the lengths of foam tape, and press the tape (sticky side down) in place on the capacitor as shown.

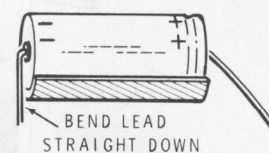


(✓) In a similar manner, install the remaining length of foam tape on the 20 μ F electrolytic capacitor.

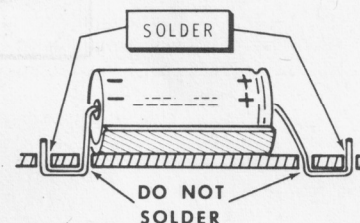
CONTINUE

(✓) C201: Install the 20 μ F electrolytic capacitor as follows:

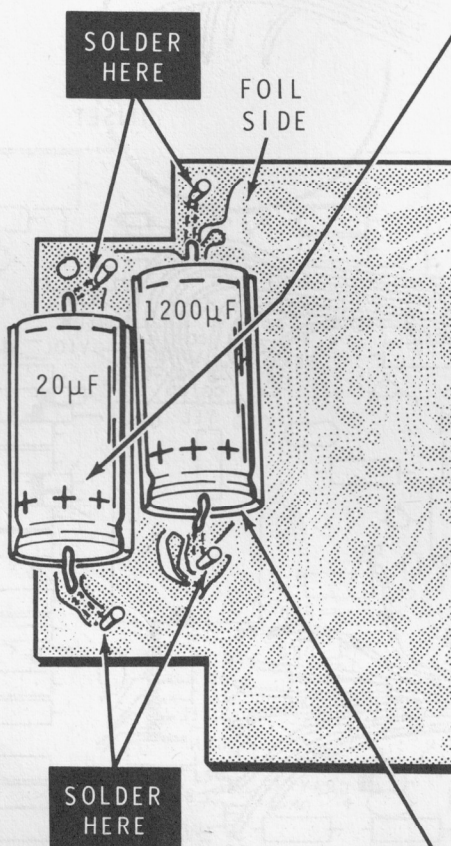
1. Cut both leads to 1-1/2".
2. Be sure the positive (+) marked end of the capacitor is positioned as shown.
3. Route the leads through the indicated pairs of holes and form the lead ends as shown. Be sure the lead at the negative (-) end of the capacitor bends straight down as shown, and be sure the capacitor is pushed down against the foam tape. (NOTE: The capacitor may not have the negative (-) markings on it.)



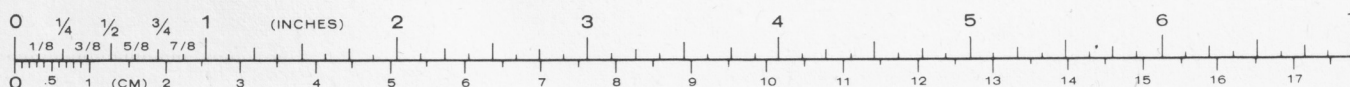
4. Be sure the leads are snug against the component side of the circuit board. Then solder the leads to the two indicated holes only.



(✓) C203: In a similar manner, install the 1200 μ F electrolytic capacitor.

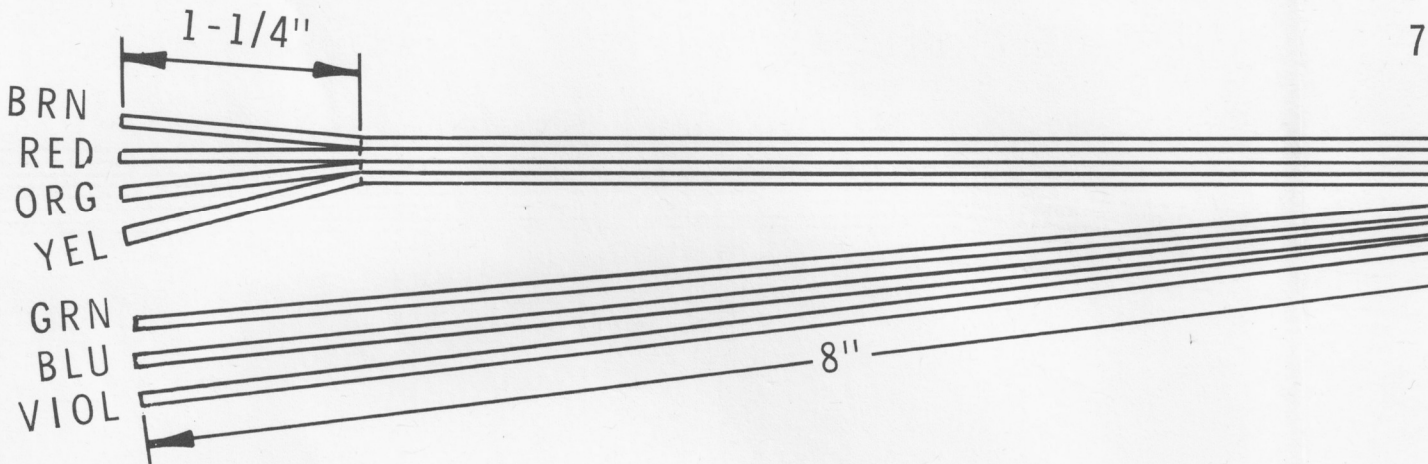


PICTORIAL 2-8



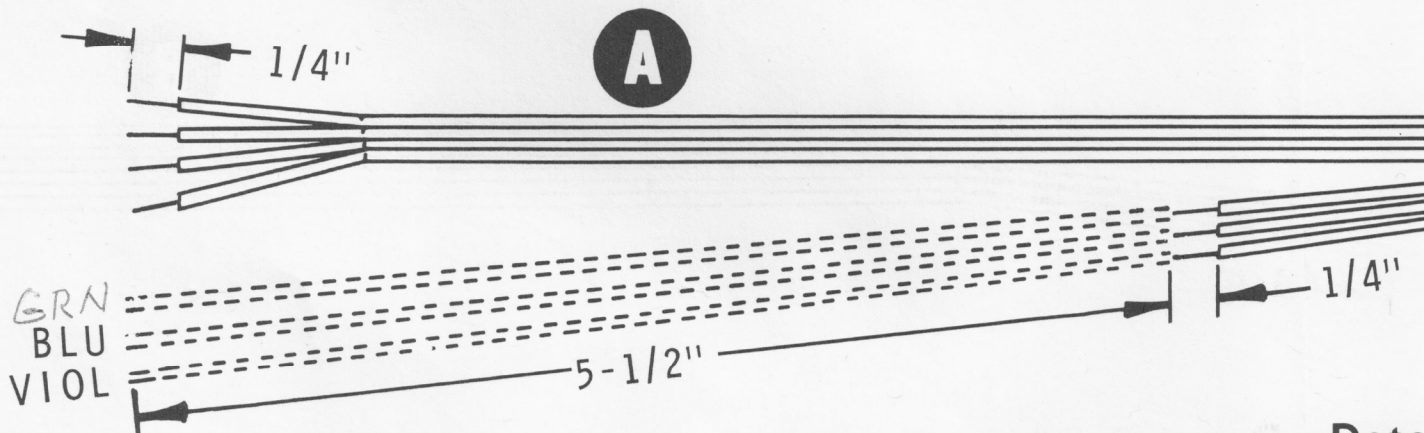
STEP 1

SEPARATE THE WIRES AS SHOWN



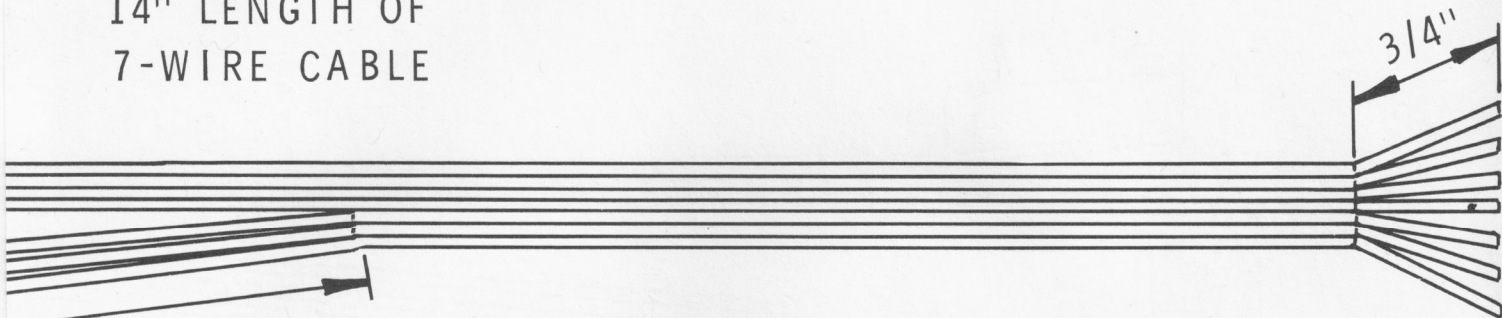
STEP 2

CUT THE WIRES AS SHOWN AND REMOVE $\frac{1}{4}$ OF INSULATION FROM EACH WIRE END

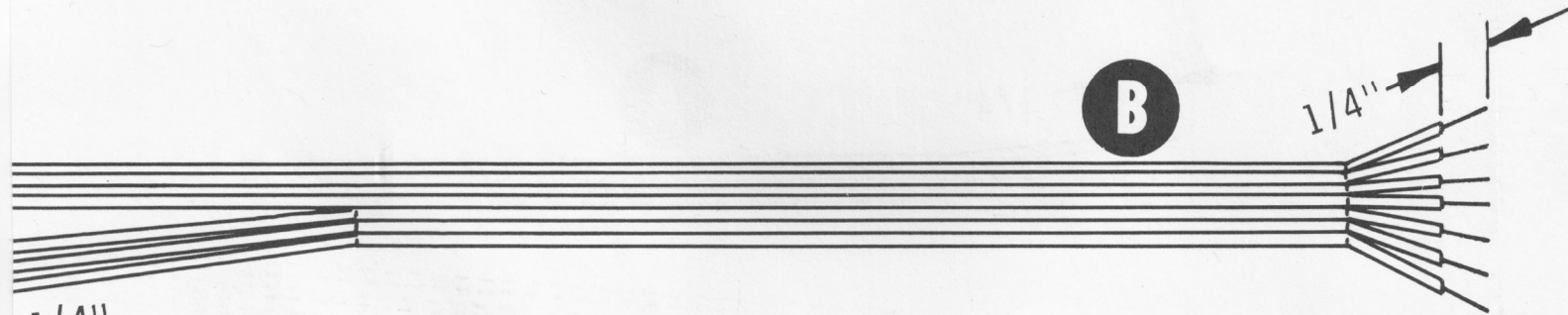


Detail

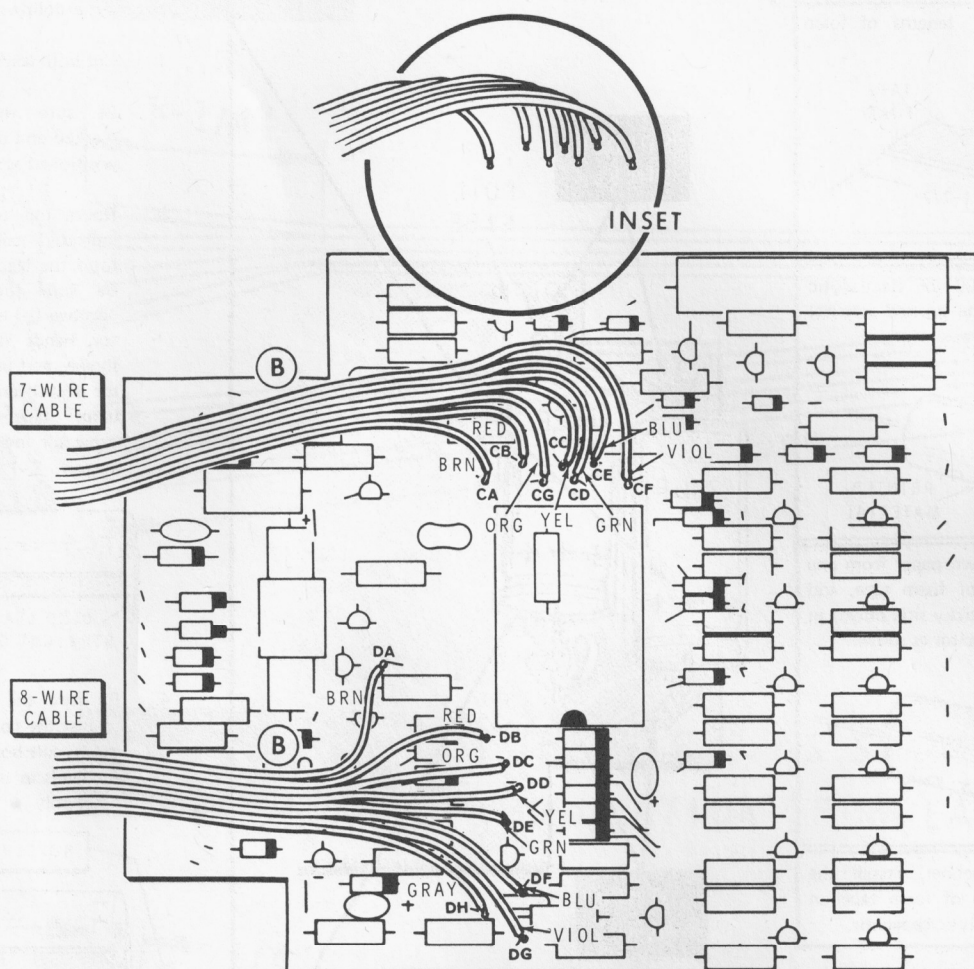
14" LENGTH OF
7-WIRE CABLE



1/4" E $1/4"$



Detail 2-9A



Refer to Pictorial 2-9 for the following steps.

NOTE: When you prepare stranded wire, twist the bare ends and apply a small amount of solder to hold the strands together.

(✓) Cut a 14" length of 8-wire cable and:

1. Remove the gray wire from the cable.
2. Refer to Detail 2-9A (fold-out from Page 28) and prepare the 7-wire cable as shown. (Save all cutoff wire for use later.) The cable is shown actual size.

Connect end B of the 7-wire cable to the main circuit board as follows: Solder each wire as you install it.

(✓) Brown to hole CA.

(✓) Red to hole CB.

(✓) Orange to hole CG.

(✓) Yellow to hole CC.

(✓) Green to hole CD.

(✓) Blue to hole CE.

(✓) Violet to hole CF.

The free end of the cable will be connected later.

() Position the 7-wire cable as shown in the inset drawing on Pictorial 2-9.

() Cut another 14" length of 8-wire cable and prepare it as shown in Detail 2-9B (fold-out from this page).

Connect end B of the 8-wire cable to the main circuit board as follows: Solder each wire as you install it.

(✓) Brown to hole DA.

(✓) Red to hole DB.

(✓) Orange to hole DC.

(✓) Yellow to hole DD.

(✓) Green to hole DE.

(✓) Blue to hole DF.

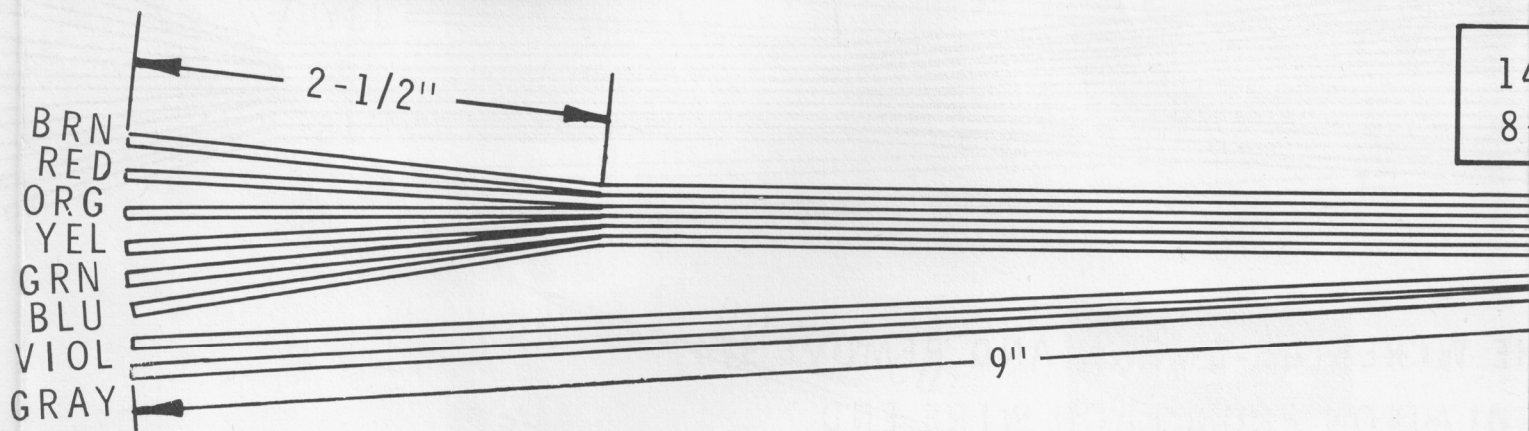
(✓) Violet to hole DG.

(✓) Gray to hole DH.

The free end of the 8-wire cable will be connected later.

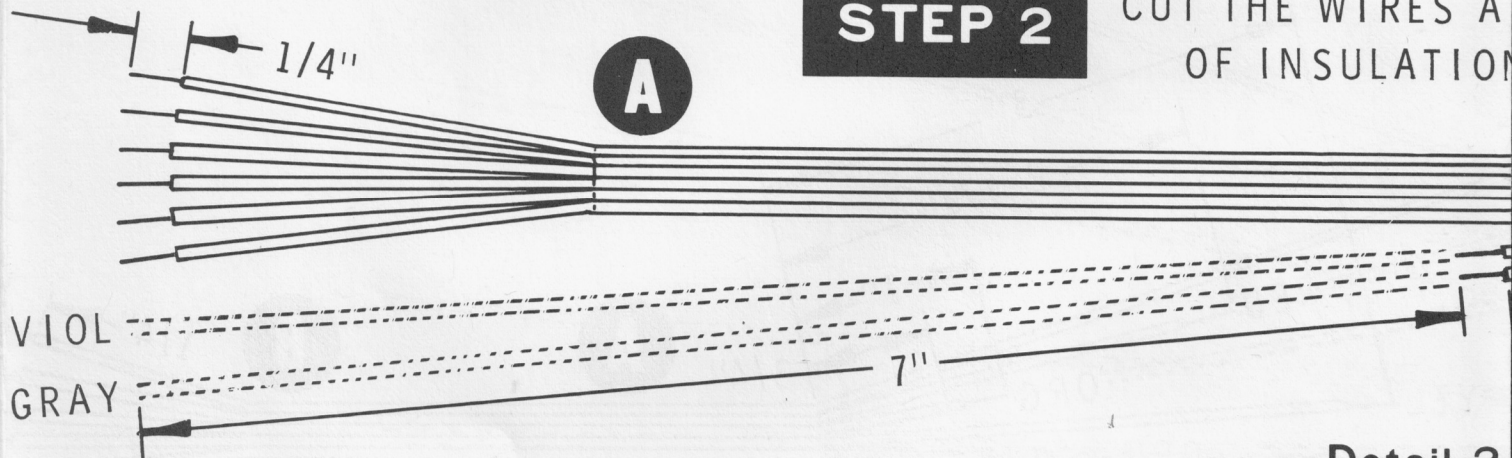
STEP 1

SEPARATE THE WIRES AS SHOWN



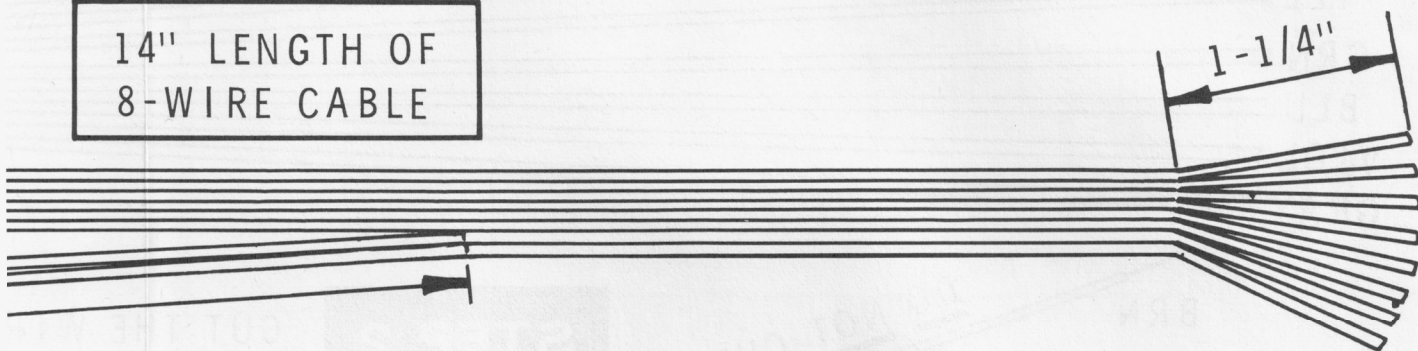
STEP 2

CUT THE WIRES AT
OF INSULATION

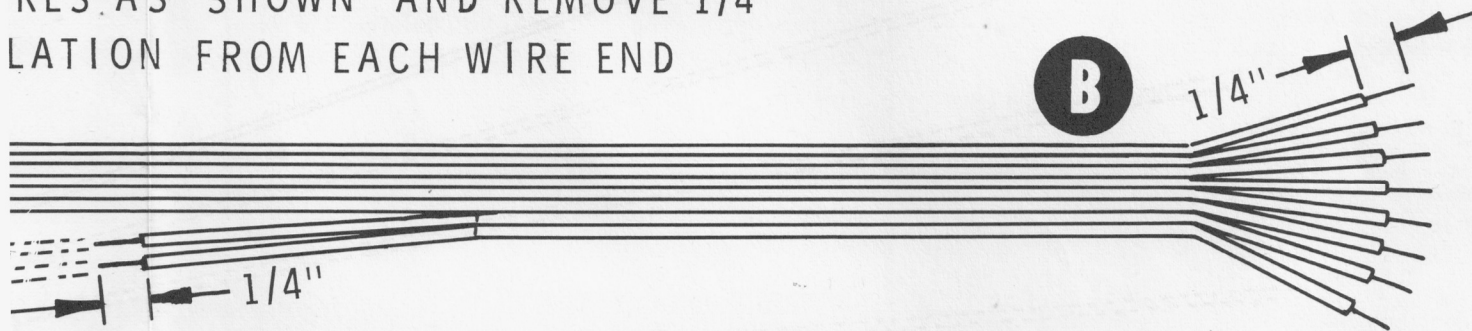


Detail 2-

14" LENGTH OF
8-WIRE CABLE



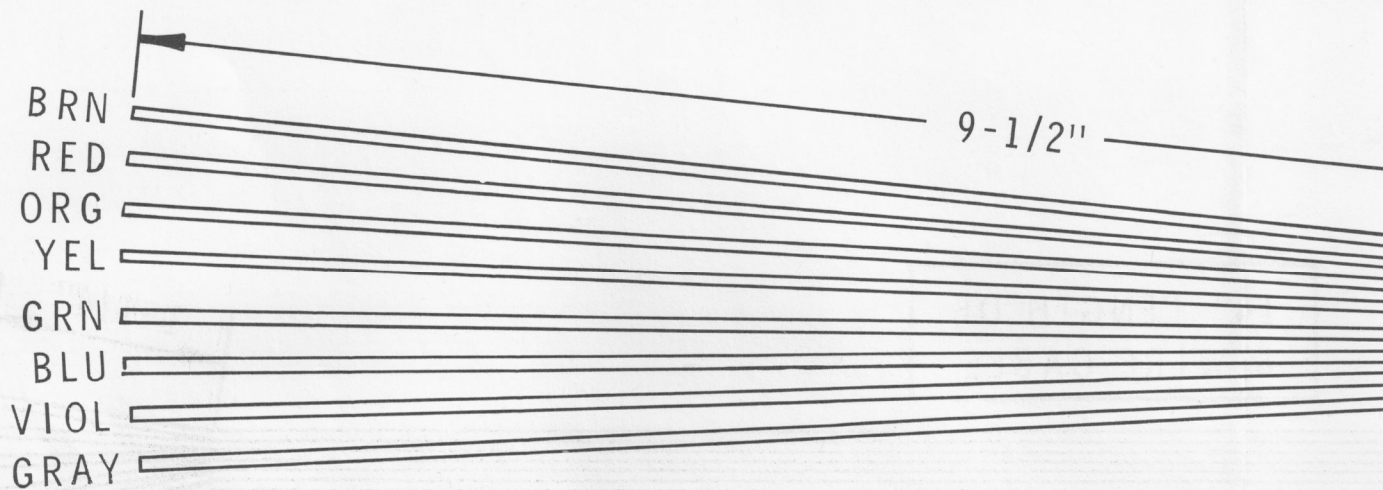
RES. AS SHOWN AND REMOVE $1/4"$
LATION FROM EACH WIRE END



etail 2-9B

STEP 1

SEPARATE THE WIRES AS SHOWN

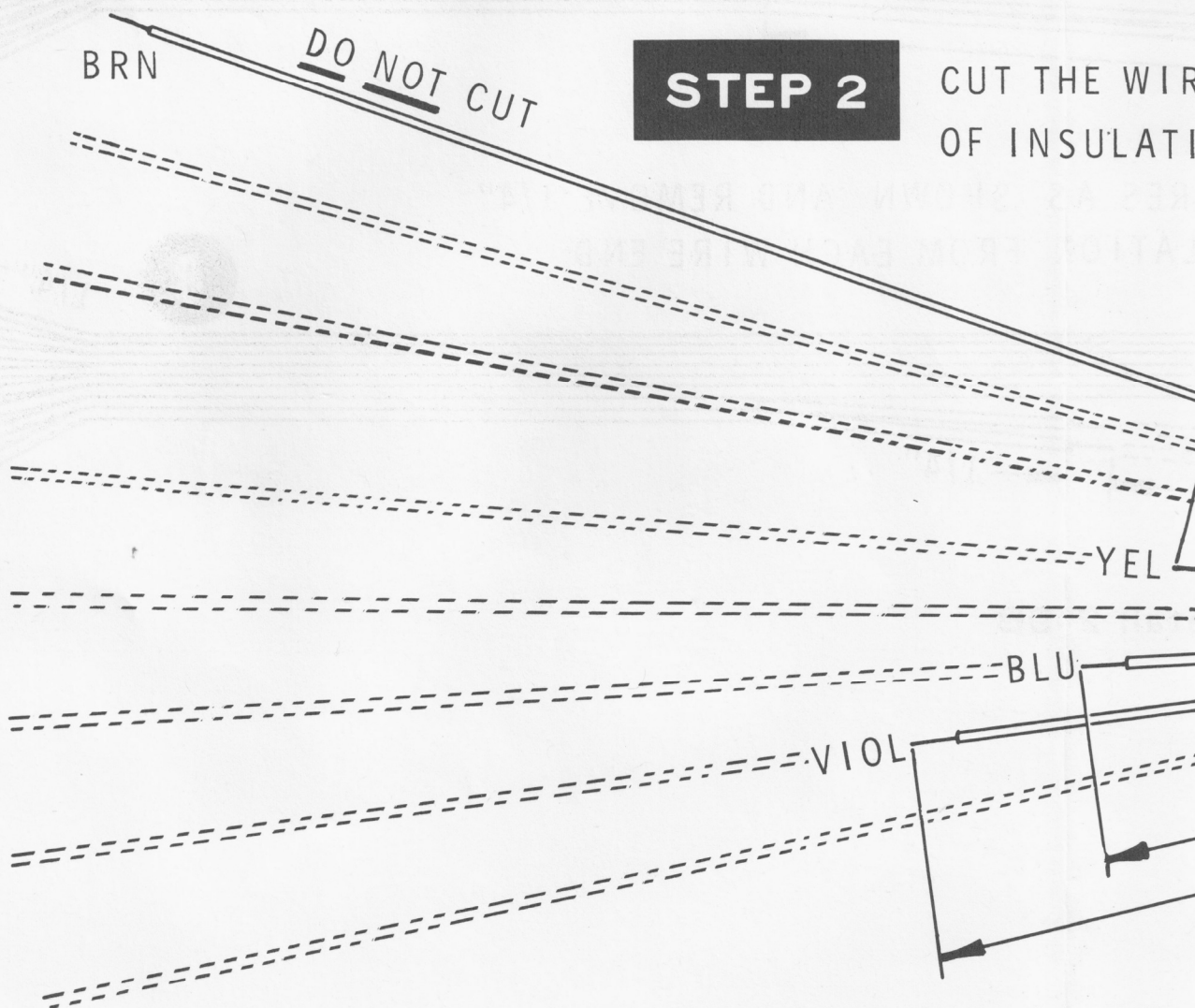


BRN

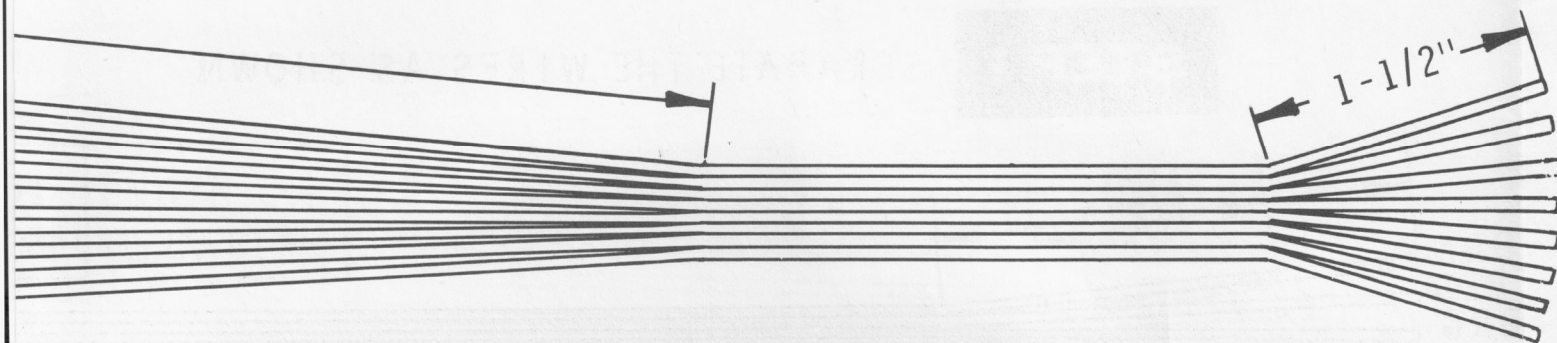
DO NOT CUT

STEP 2

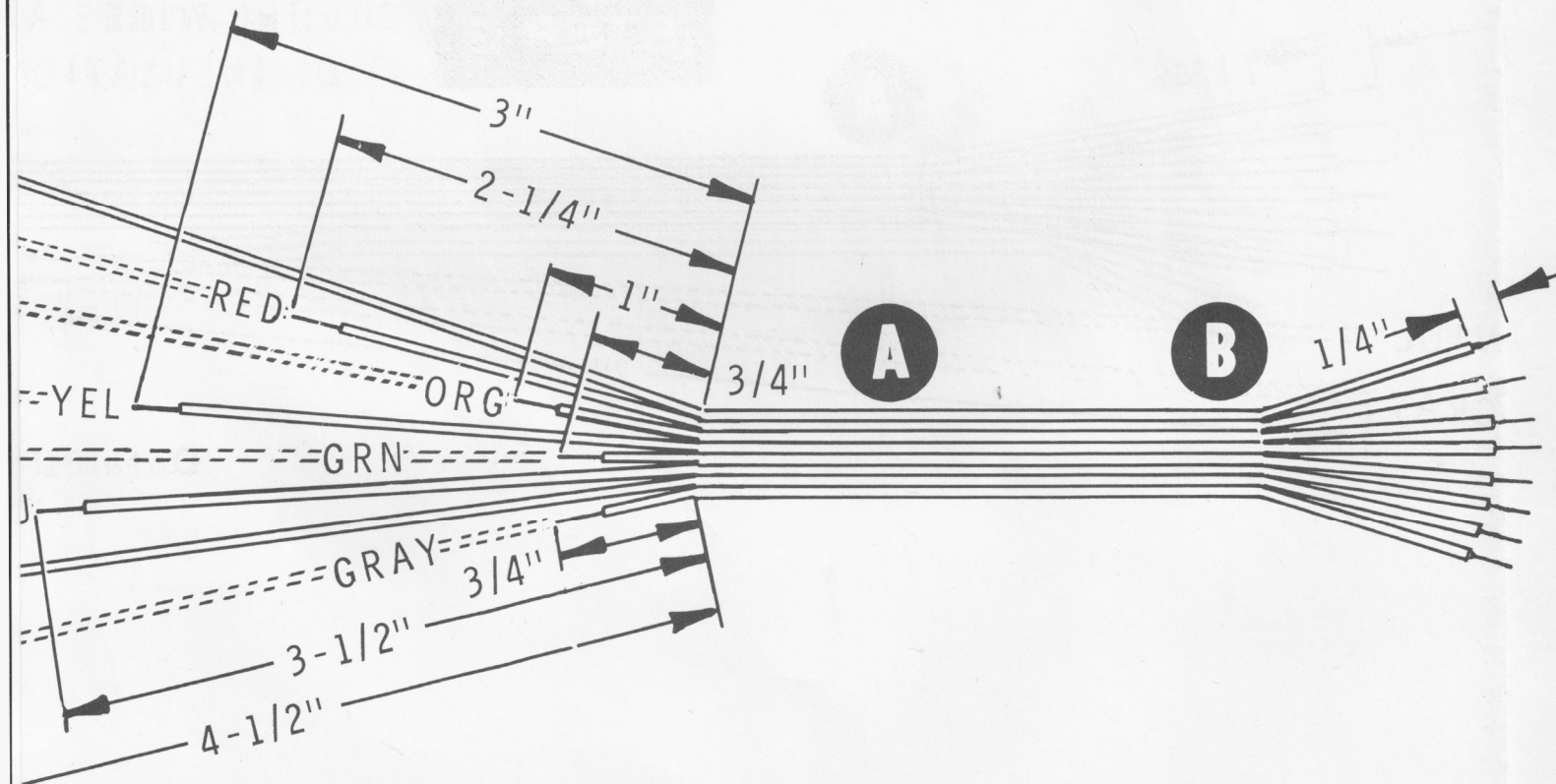
CUT THE WIRE
OF INSULATION



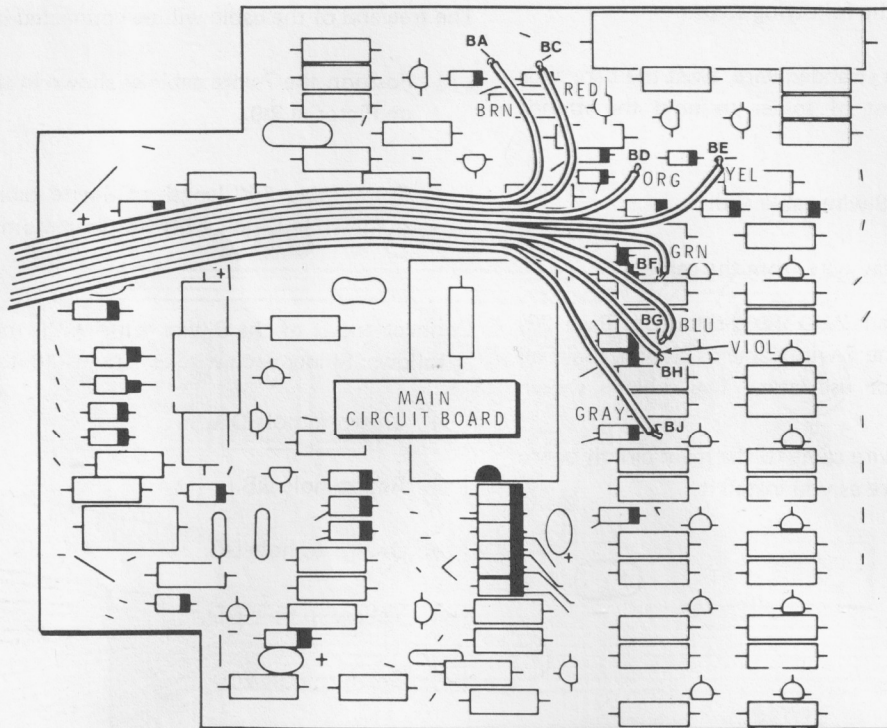
14" LENGTH OF
8-WIRE CABLE



THE WIRES AS SHOWN AND REMOVE 1/4" INSULATION FROM EACH WIRE END



Detail 2-10A



PICTORIAL 2-10

Refer to Pictorial 2-10 for the following steps.

- (✓) Cut another 14" length of 8-wire cable and prepare it as shown in Detail 2-10A.

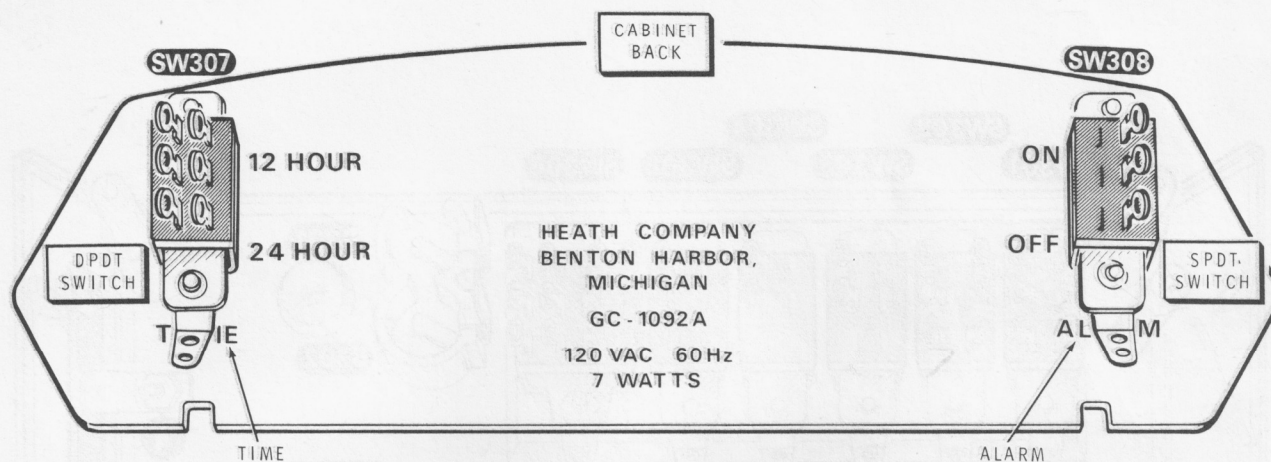
Connect end B of the 8-wire cable to the main circuit board as follows: Solder each wire as you install it.

- (✓) Brown to hole BA.
- (✓) Red to hole BC.
- (✓) Orange to hole BD.
- (✓) Yellow to hole BE.
- (✓) Green to hole BF.
- (✓) Blue to hole BG. NOTE: The letters BG are covered up by a nearby resistor.
- (✓) Violet to hole BH. NOTE: The letters BH are covered up by a nearby resistor.
- (✓) Gray to hole BJ.
- (✓) Set the circuit board aside temporarily. NOTE: One resistor is left over and will be used later.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections. NOTE: Component locations R251, R252, R258, R259, Q224, C210, and D225 are not used in this kit.
- (✓) "Cold" solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Diodes for the correct position of the banded end. The bands should all be to the right as shown in Pictorial 2-20.
- (✓) Transistors for the proper type and installation.
- (✓) Tantalum capacitors for the correct position of the positive (+) end.

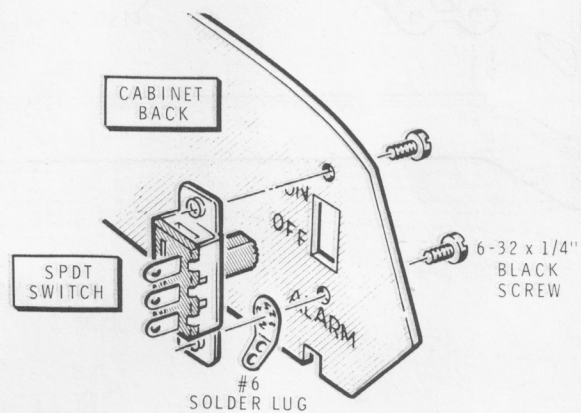


PICTORIAL 3-1

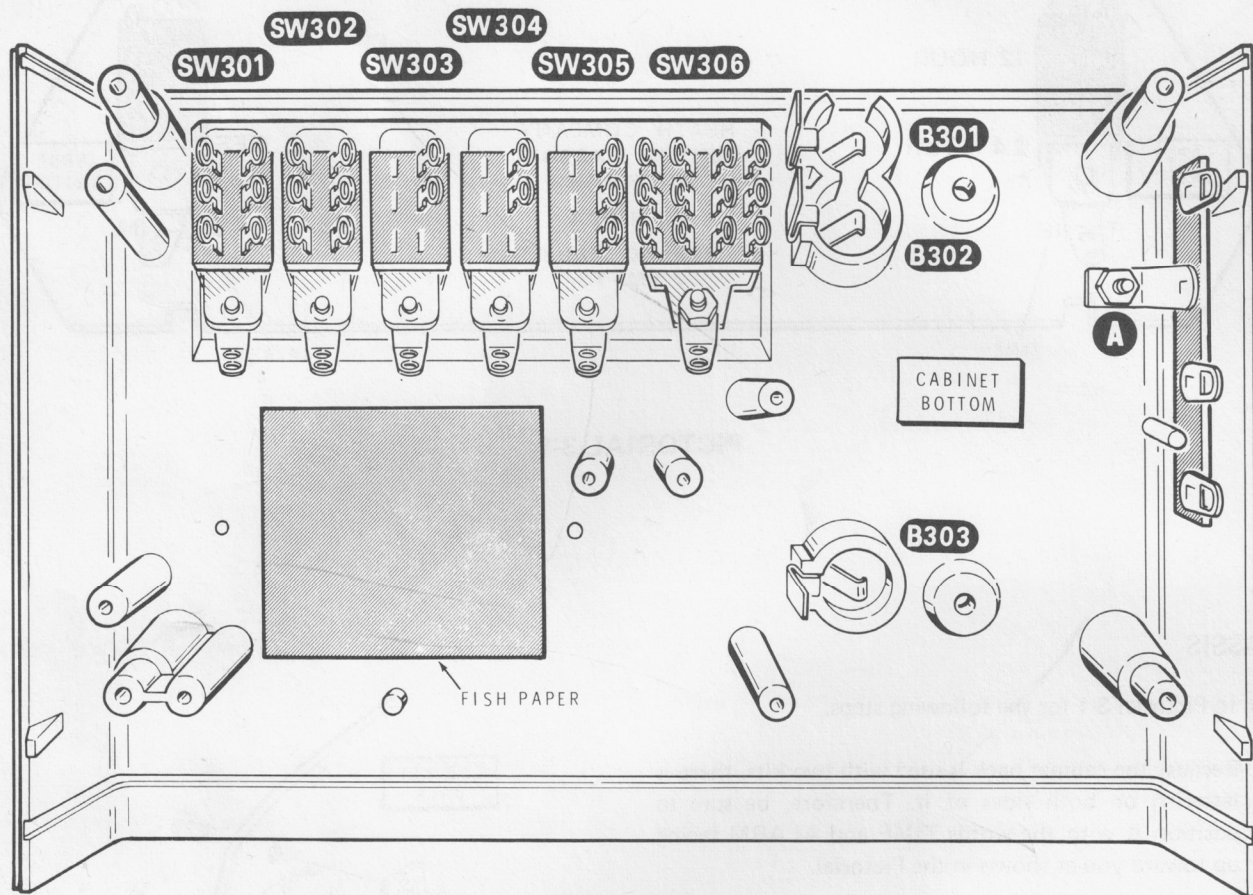
CHASSIS

Refer to Pictorial 3-1 for the following steps.

- (✓) Because the cabinet back is used with two kits, there is lettering on both sides of it. Therefore, be sure to position it with the words TIME and ALARM facing up toward you as shown in the Pictorial.
- (✓) SW308: Refer to Detail 3-1A and install an SPDT (3-lug) switch as shown. Use two 6-32 x 1/4" screws and a #6 solder lug.
- (✓) SW307: In a similar manner, install a DPDT (6-lug) switch at SW307.
- (✓) Set aside the cabinet back temporarily.



Detail 3-1A



PICTORIAL 3-2

Refer to Pictorial 3-2 for the following steps.

(✓) Position the cabinet bottom as shown in the Pictorial.

(✓) Remove the protective backing from the fish paper and press the fish paper in place over the grille area.

NOTE: When you install the next five switches, refer to Detail 3-2A and use two 6-32 x 3/8" flat head screws and a #6 solder lug to mount each switch. Position the solder lugs as shown.

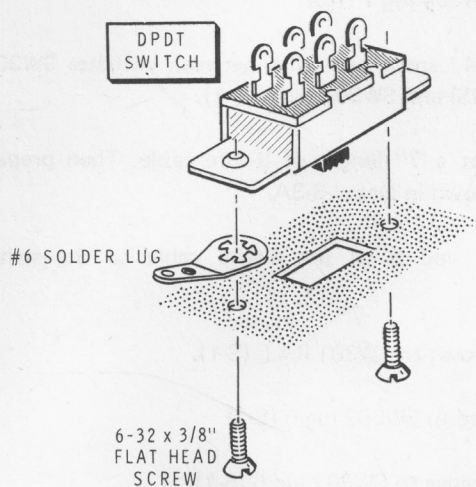
(✓) SW301: DPDT (6-lug) switch.

(✓) SW302: DPDT (6-lug) switch.

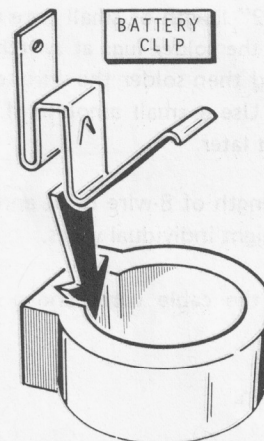
(✓) SW303: SPST (2-lug) switch. Position the switch lugs as shown.

(✓) SW304: SPST (2-lug) switch. Position the switch lugs as shown.

(✓) SW305: SPDT (3-lug) switch. Position the switch lugs as shown.



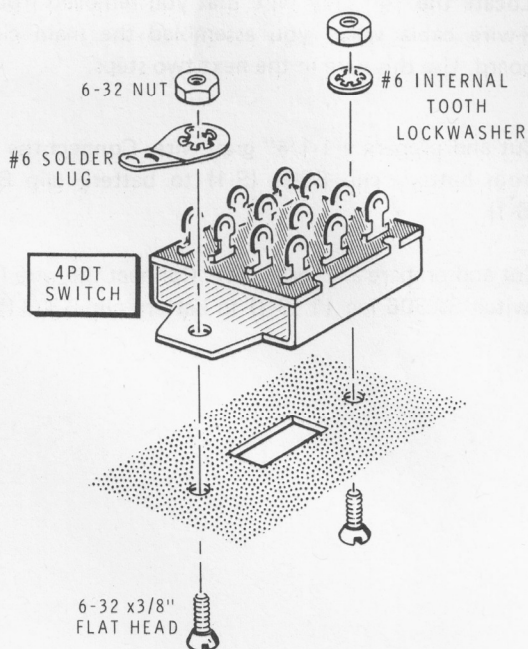
Detail 3-2A



Detail 3-2C

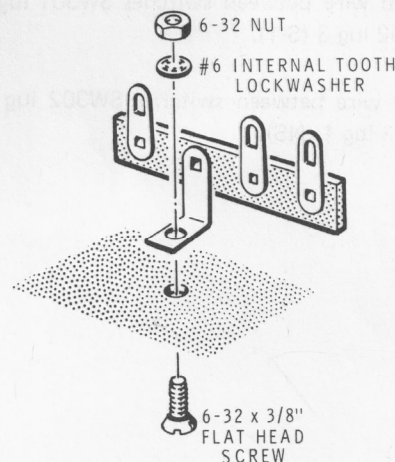
NOTE: Use the plastic nut starter supplied with this kit to hold and start 6-32 and 4-40 nuts on screws.

- (✓) SW306: 4PDT (12-lug) switch. Refer to Detail 3-2B and use two 6-32 x 3/8" flat head screws, a #6 solder lug, a #6 internal tooth lockwasher, and two 6-32 nuts as shown.



Detail 3-2B

- (✓) Refer to Detail 3-2C and push a battery clip into position at B301.
- (✓) In a similar manner, install battery clips at B302 and B303.
- (✓) Refer to Detail 3-2D and install the terminal strip at A. Use a 6-32 x 3/8" flat head screw, a #6 internal tooth lockwasher, and a 6-32 nut.



Detail 3-2D

Refer to Pictorial 3-3 for the following steps.

- (✓) Cut a 3-1/2" length of small bare wire. Lay this wire on top of the solder lugs at switches SW301 through SW306, and then solder the wire to the six solder lugs as shown. Use a small amount of solder. These lugs will be bent later.
- (✓) Cut a 3" length of 8-wire cable and separate the cable wires into eight individual wires.

Prepare four of the cable wires and a small bare wire as follows:

- (✓) 2-1/2" brown.
- (✓) 2-1/2" red
- (✓) 3" yellow
- (✓) 3" green
- (✓) 3/4" small bare

NOTE: In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.

Connect the wires as follows and route them as shown:

- (✓) 2-1/2" brown wire between switches SW301 lug 1 (NS) and SW302 lug 4 (S-1).
- (✓) 2-1/2" red wire between switches SW301 lug 2 (S-1) and SW302 lug 3 (S-1).
- (✓) 3" yellow wire between switches SW302 lug 2 (S-1) and SW303 lug 1 (NS).

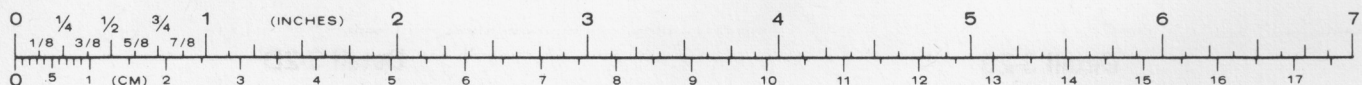
- (✓) 3" green wire between switches SW302 lug 5 (NS) and SW304 lug 1 (NS).
- (✓) 3/4" small bare wire between switches SW301 lug 4 (NS) and SW302 lug 1 (S-1).
- (✓) Cut a 7" length of 8-wire cable. Then prepare it as shown in Detail 3-3A.

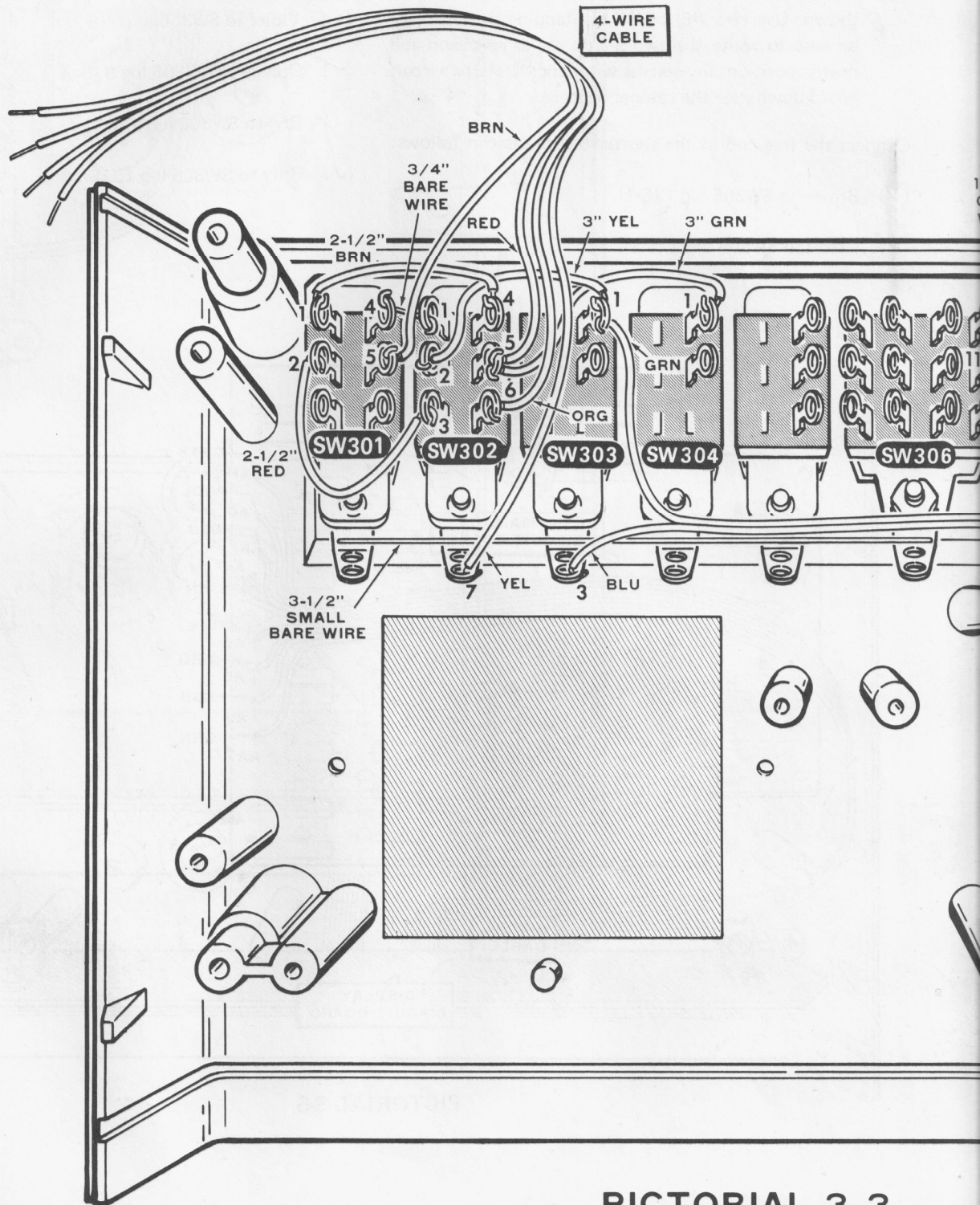
Connect end B of the 4-wire cable to the switches as follows:

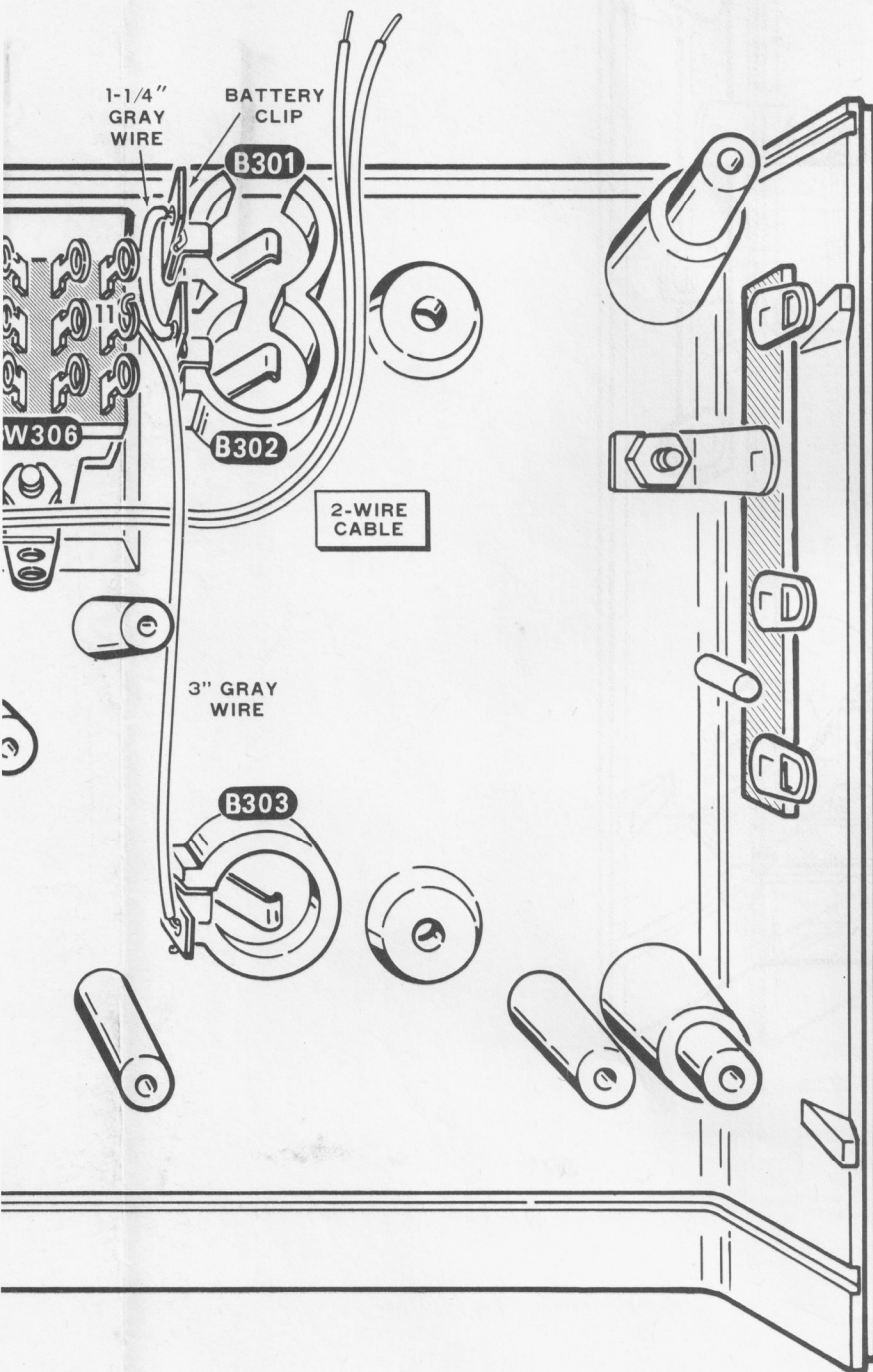
- (✓) Brown to SW301 lug 5 (S-1).
- (✓) Red to SW302 lug 5 (S-2).
- (✓) Orange to SW302 lug 6 (S-1).
- (✓) Yellow to SW302 lug 7 (S-1).

Connect either end of the green and blue 2-wire cable as follows:

- (✓) Green to SW303 lug 1 (NS).
- (✓) Blue to SW303 lug 3 (S-1).
- (✓) Lay the remaining 2-wire cable aside until it is called for.
- (✓) Locate the 14" gray wire that you removed from an 8-wire cable when you assembled the main circuit board. Use this wire in the next two steps.
- (✓) Cut and prepare a 1-1/4" gray wire. Connect the wire from battery clip B301 (S-1) to battery clip B302 (S-1).
- (✓) Cut and prepare a 3" gray wire. Connect the wire from switch SW306 lug 11 (S-1) to battery clip B303 (S-1).

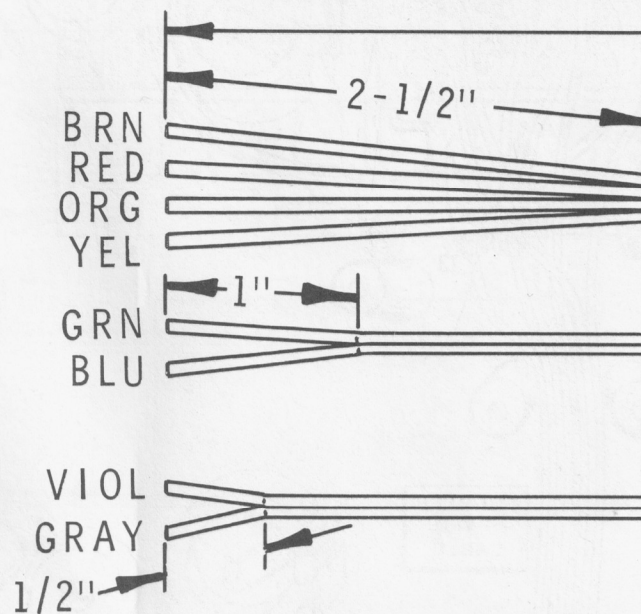






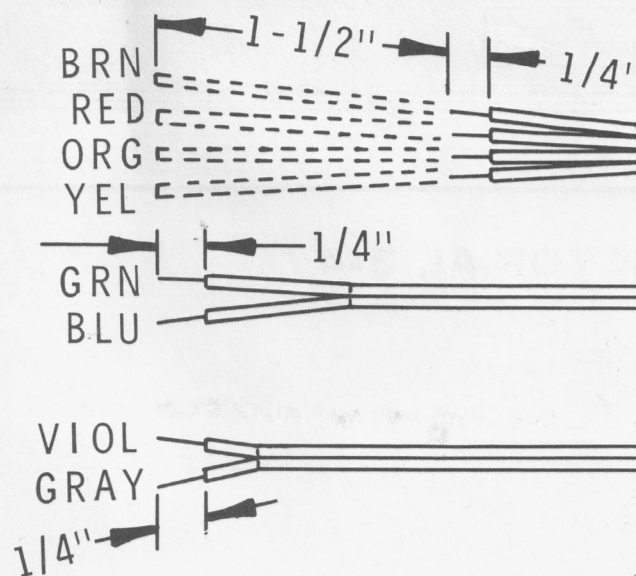
STEP 1

SEPARATE

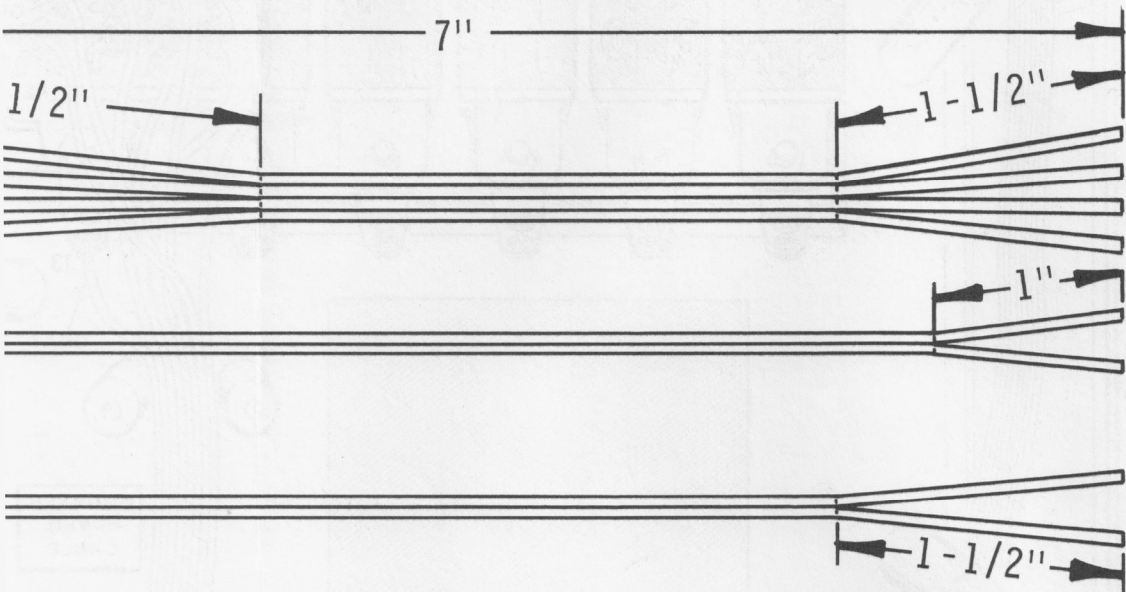


STEP 2

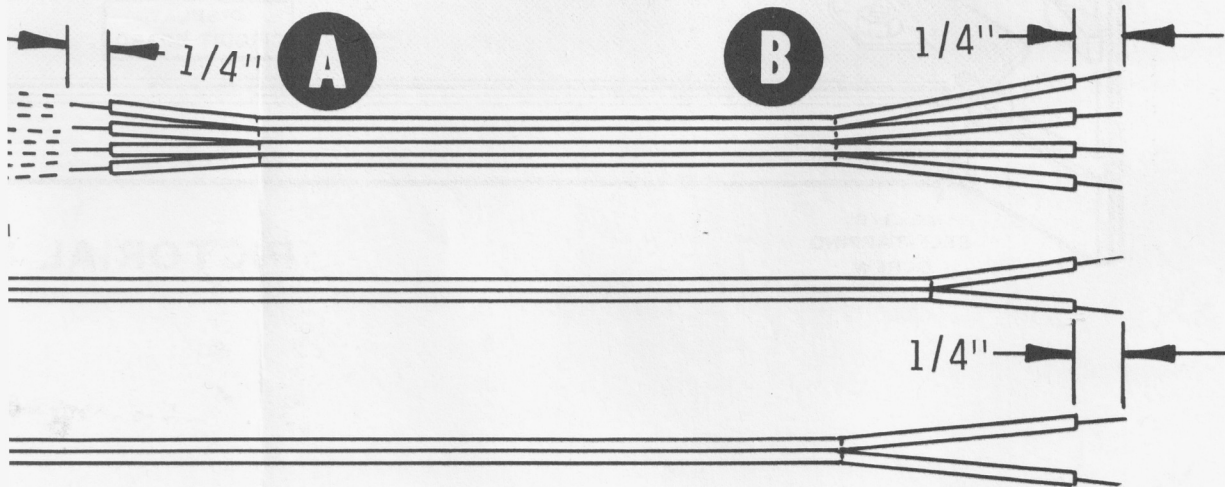
CUT THE W
REMOVE 1/



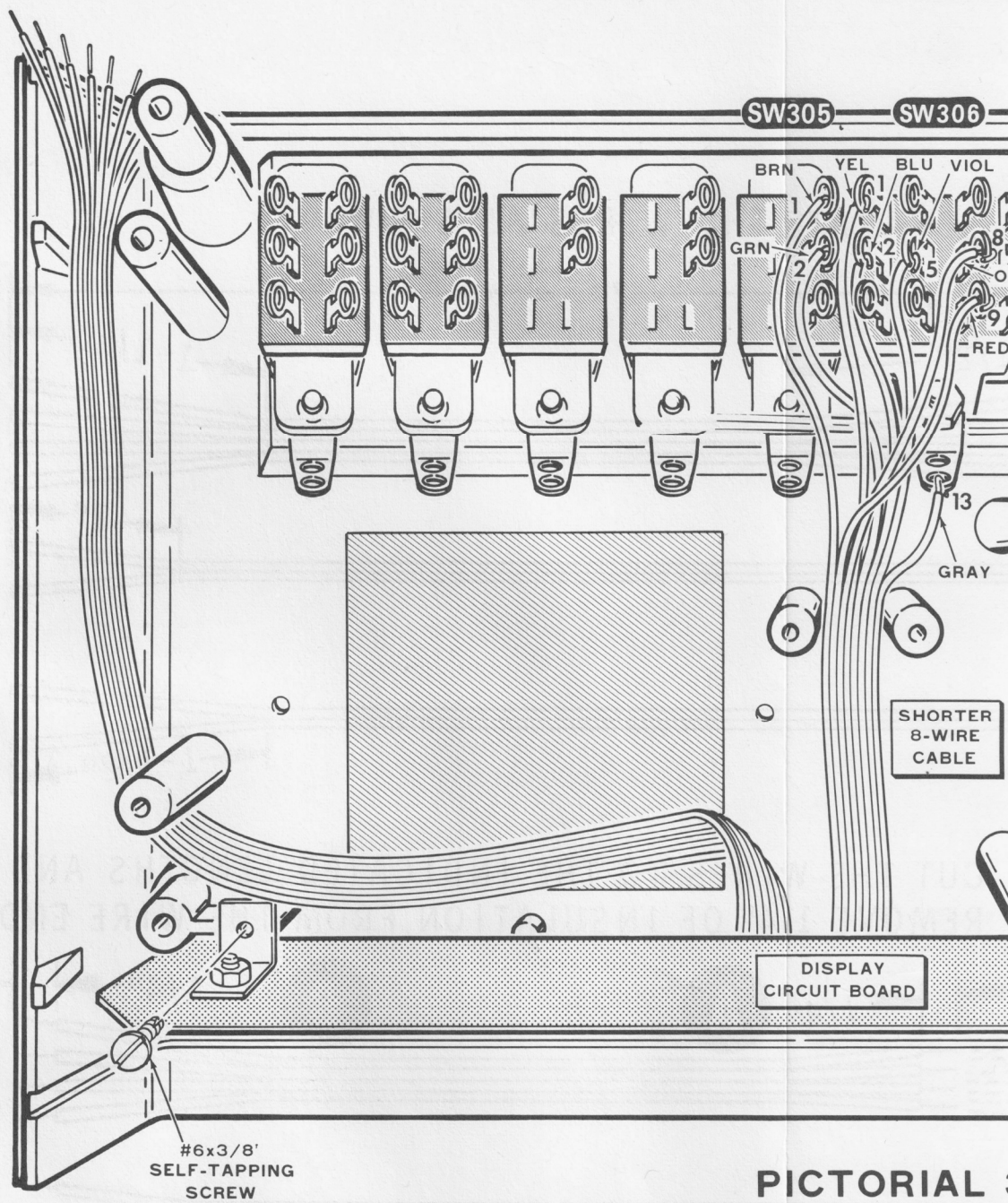
SEPARATE THE WIRES AS SHOWN



CUT THE WIRES TO THE INDICATED LENGTHS AND REMOVE 1/4" OF INSULATION FROM THE WIRE ENDS.



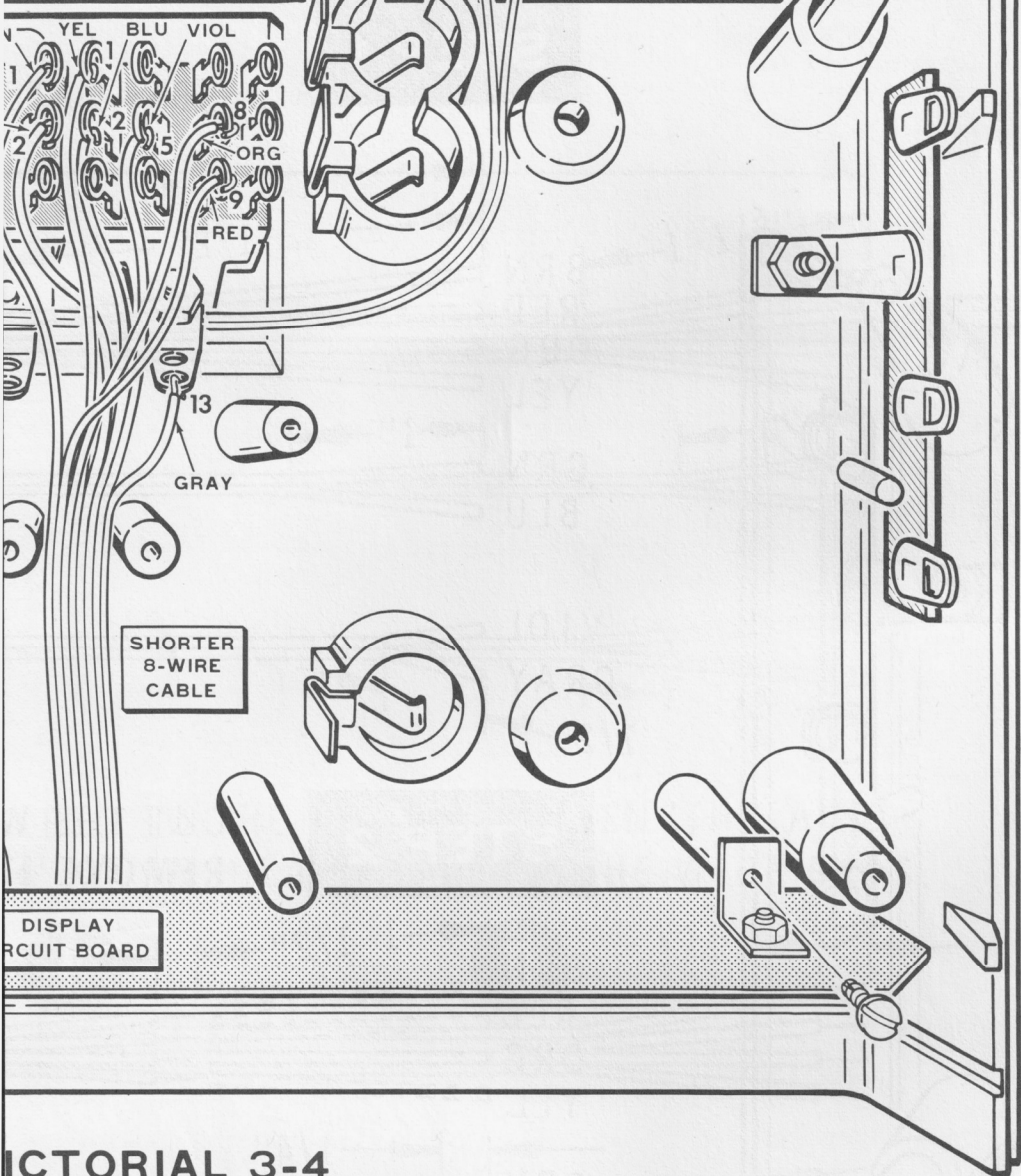
Detail 3-3A



PICTORIAL

305

SW306



VICTORIAL 3-4

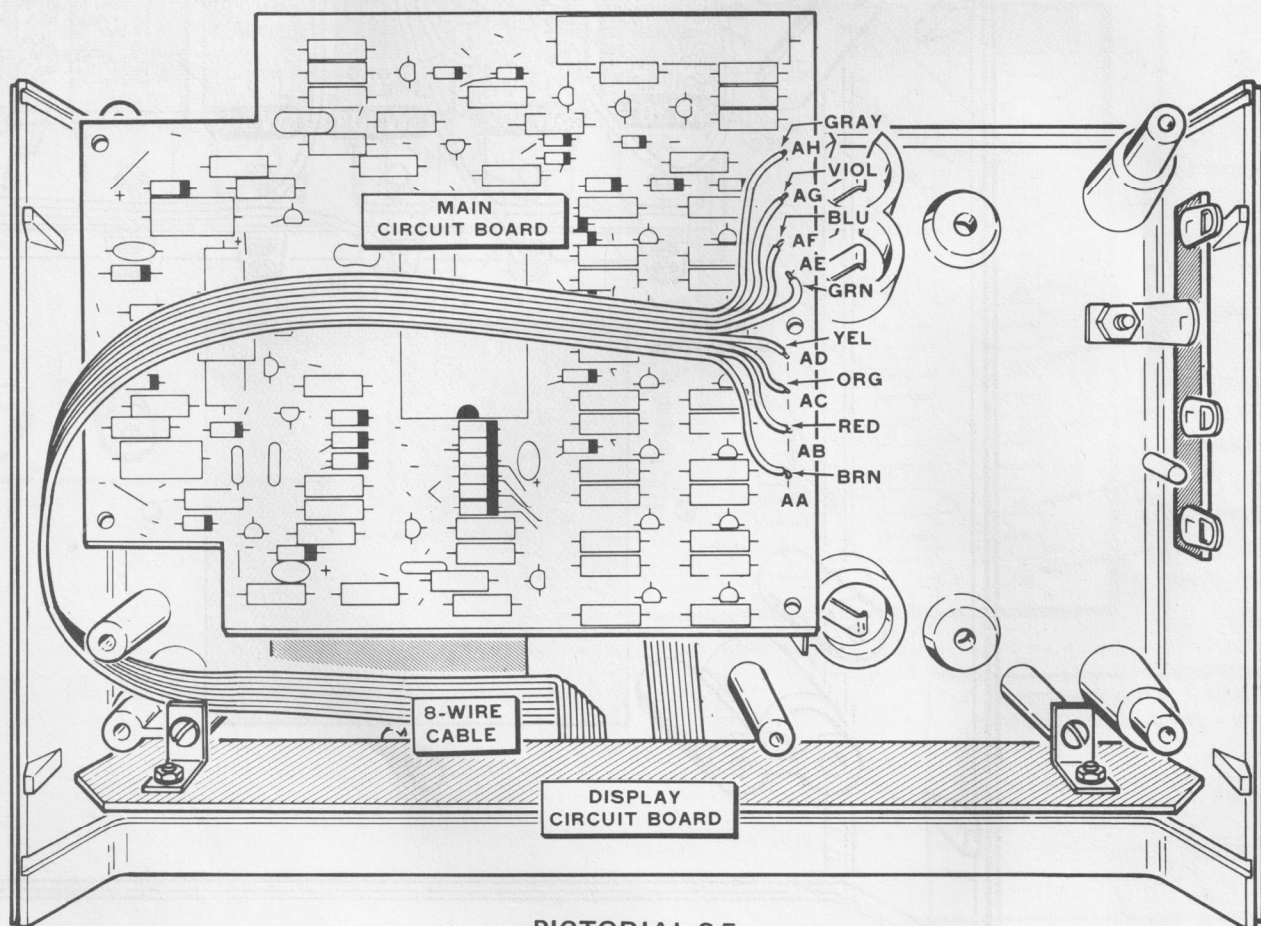
Refer to Pictorial 3-4 (fold-out from this page) for the following steps.

- (✓) Temporarily mount the display circuit board as shown. Use two #6 x 3/8" self-tapping screws. Also, be sure to route the two 8-wire cables as shown and neatly position any excess wire lengths of the circuit board down near the cabinet bottom.

Connect the free end of the shorter 8-wire cable as follows:

- (✓) Brown to SW305 lug 1 (S-1).
- (✓) Green to SW305 lug 2 (S-1).

- (✓) Yellow to SW306 lug 1 (S-1).
- (✓) Blue to SW306 lug 2 (NS).
- (✓) Violet to SW306 lug 5 (S-1).
- (✓) Orange to SW306 lug 8 (S-1).
- (✓) Red to SW306 lug 9 (S-1).
- (✓) Gray to SW306 lug 13 (S-1).



PICTORIAL 3-5

Refer to Pictorial 3-5 for the following steps.

- (✓) Position the main circuit board as shown. Then connect the free end of the other 8-wire cable coming from the display circuit board to the main circuit board as follows:

- (✓) Gray to hole AH (S-1).
- (✓) Violet to hole AG (S-1).
- (✓) Blue to hole AF (S-1).
- (✓) Green to hole AE (S-1).
- (✓) Yellow to hole AD (S-1).
- (✓) Orange to hole AC (S-1).
- (✓) Red to hole AB (S-1).
- (✓) Brown to hole AA (S-1).

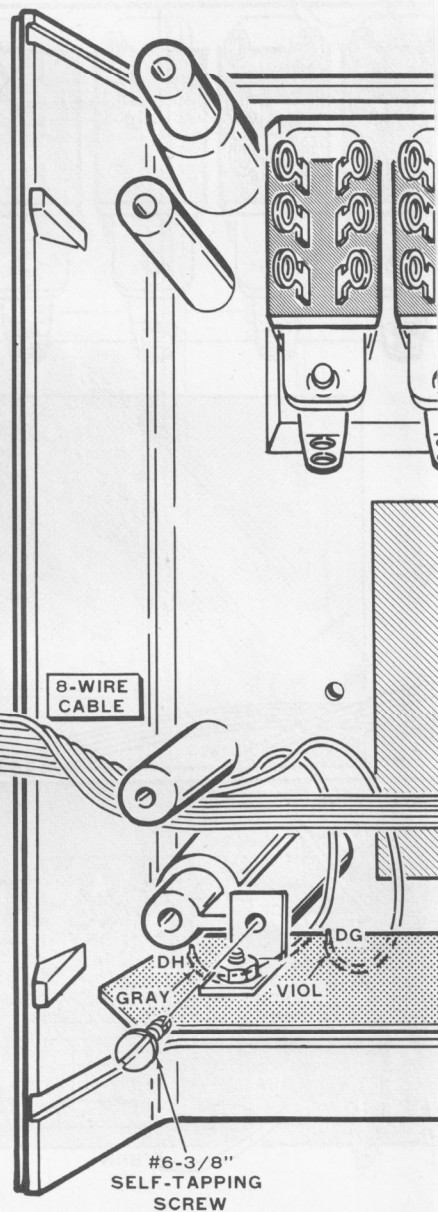
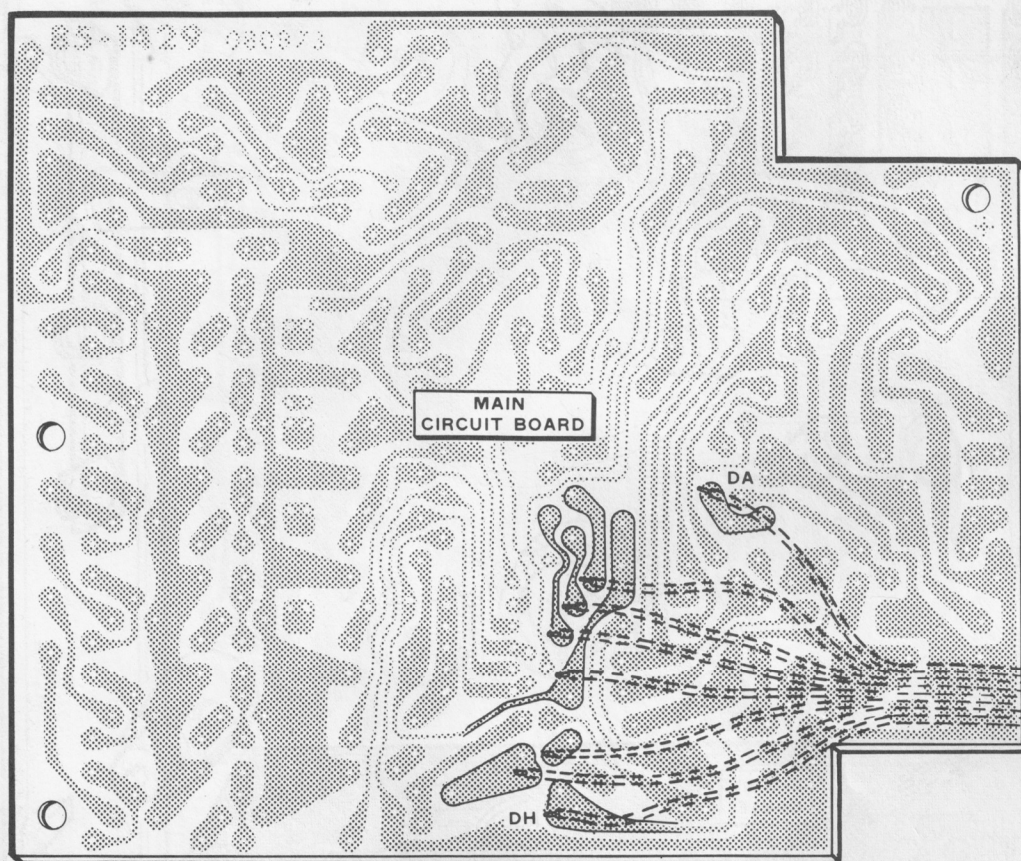
Refer to Pictorial 3-6 for the following steps.

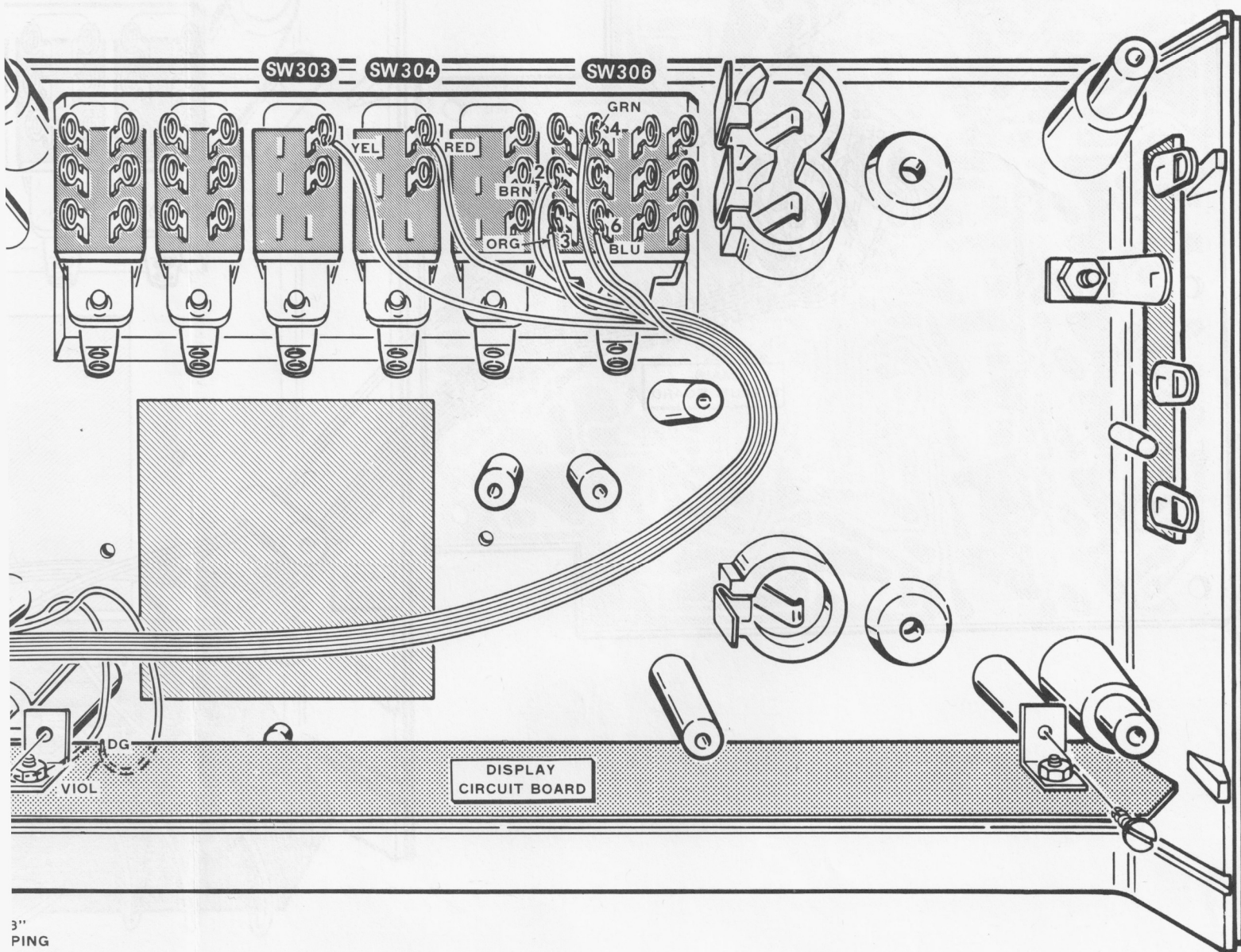
- () Position the main circuit board as shown.

- () Temporarily remove the two #6 x 3/8" self-tapping screws that hold the display circuit board in place.

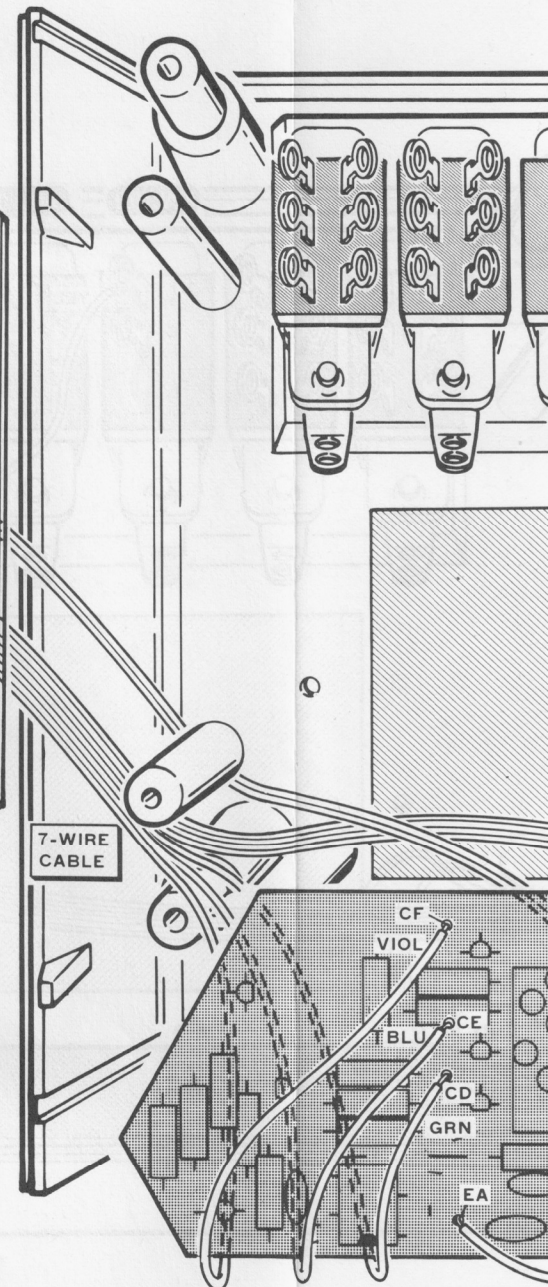
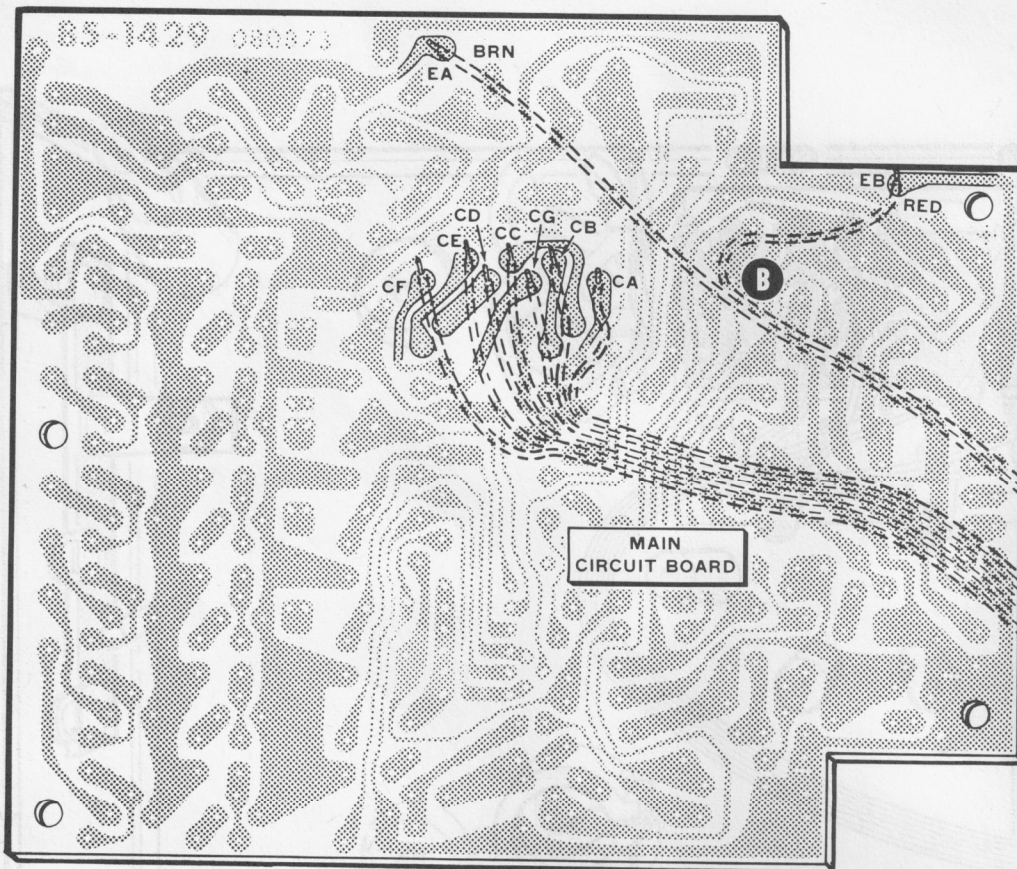
Connect the free end of the 8-wire cable coming from holes DA through DH in the main circuit board to the display circuit board and switches as follows:

- (✓) Route the gray and violet wires under the display circuit board. Then connect the gray wire to hole DH (S-1) and the violet wire to hole DG (S-1).
- (✓) Reinstall the display circuit board.
- (✓) Brown to SW306 lug 2 (S-2).
- (✓) Red to SW304 lug 1 (S-2).
- (✓) Orange to SW306 lug 3 (S-1).
- (✓) Yellow to SW303 lug 1 (S-3).
- (✓) Green to SW306 lug 4 (S-1).
- (✓) Blue to SW306 lug 6 (S-1).
- () Be sure the cable is routed as shown.

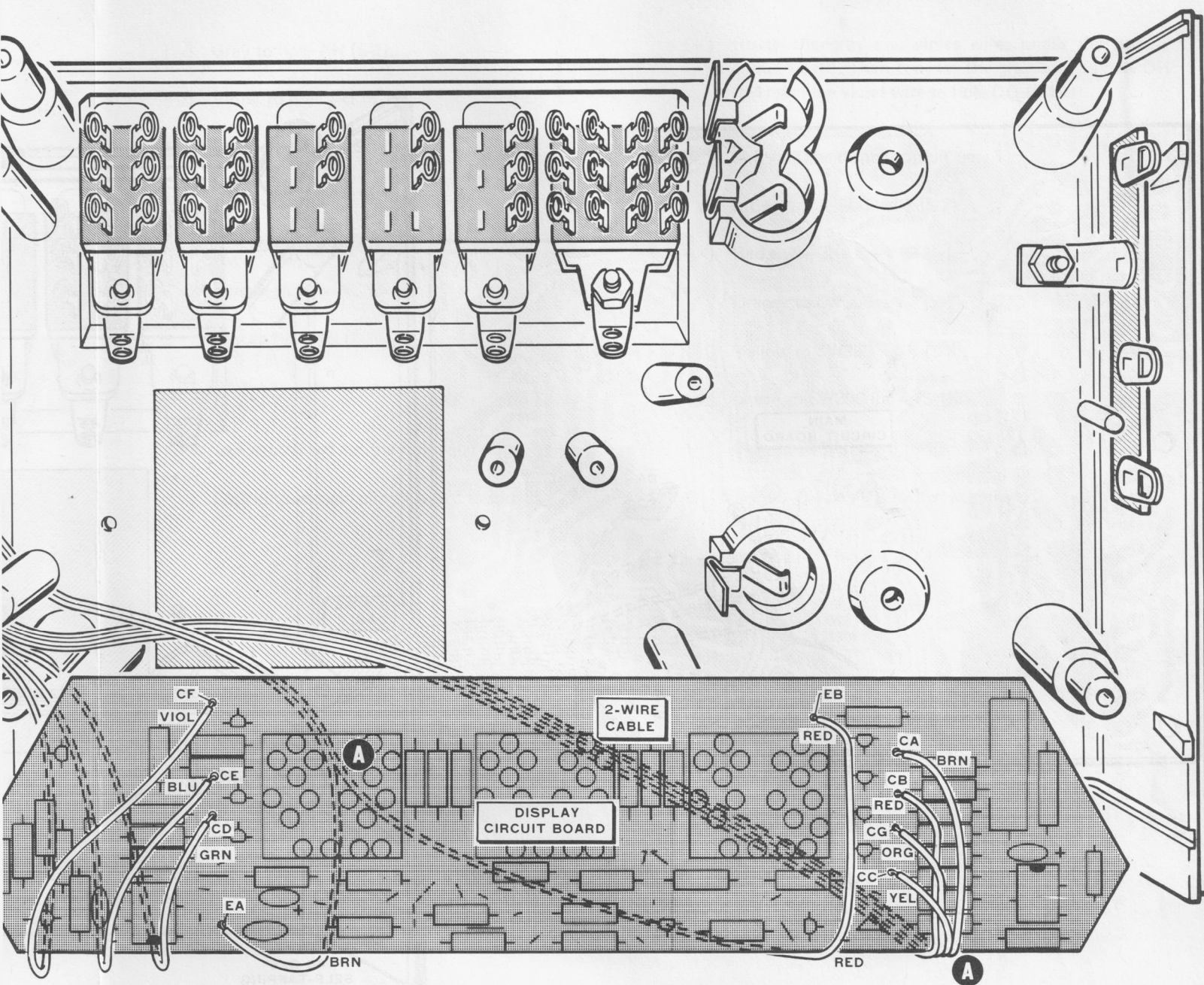




PICTORIAL 3-6



PICTORIAL 3



PICTORIAL 3-7

Refer to Pictorial 3-7 (fold-out from this page) for the following steps. NOTE: The display circuit board is still installed, even though it does not appear that way in the Pictorial.

Connect the free end of the 7-wire cable coming from holes CA through CG in the main circuit board to the display circuit board as follows. Route the cable as shown.

- (✓) Position the green, blue, and violet wires under the display circuit board as shown.
- (✓) Green to hole CD (S-1).
- (✓) Blue to hole CE (S-1).
- (✓) Violet to hole CF (S-1).
- () Position the brown, red, orange, and yellow wires under the display circuit board as shown.
- (✓) Yellow to hole CC (S-1).
- (✓) Orange to hole CG (S-1).
- () Red to hole CB (S-1).

(✓) Brown to hole CA (S-1).

(✓) Refer to Detail 3-7A (fold-out from Page 39) and prepare a 15" length of 8-wire cable as shown.

(✓) Connect end B of the 2-wire cable to the main circuit board as follows:

(✓) Brown wire to hole EA (S-1).

(✓) Red wire to hole EB (S-1).

(✓) Route end A of the cable under the display circuit board as shown and connect it to the display circuit board as follows.

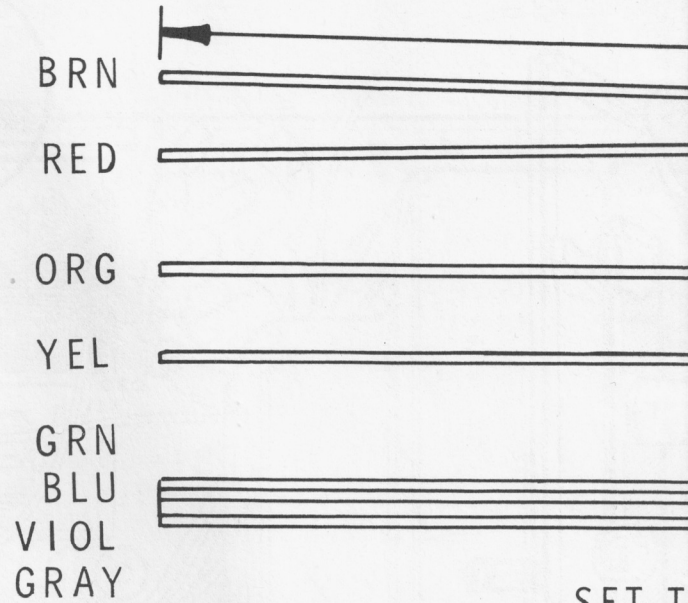
(✓) Brown wire to hole EA (S-1).

(✓) Red wire to hole EB (S-1).

NOTE: The orange and yellow wires will be used later.

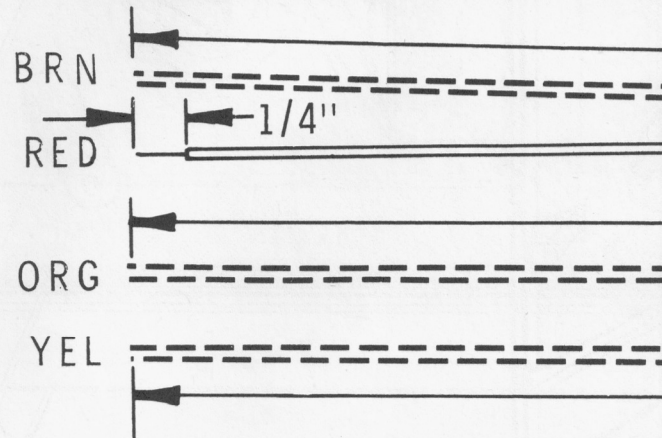
STEP 1

SEPARATE T

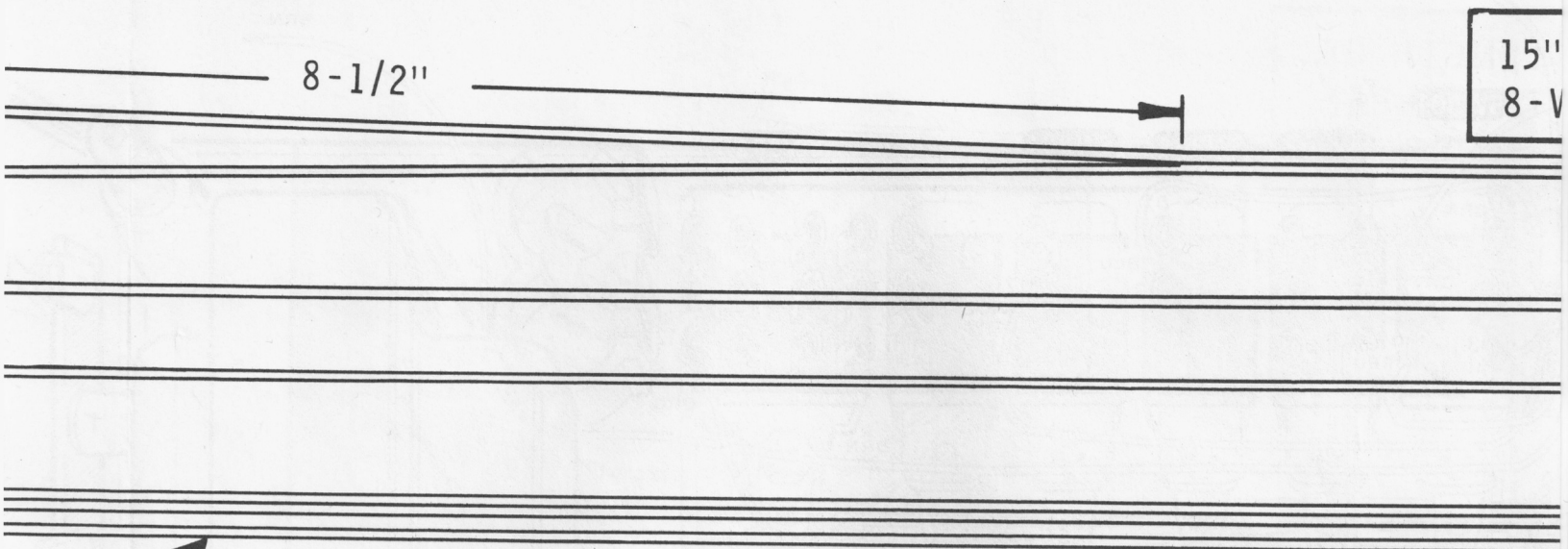


STEP 2

CUT THE
REMOVE

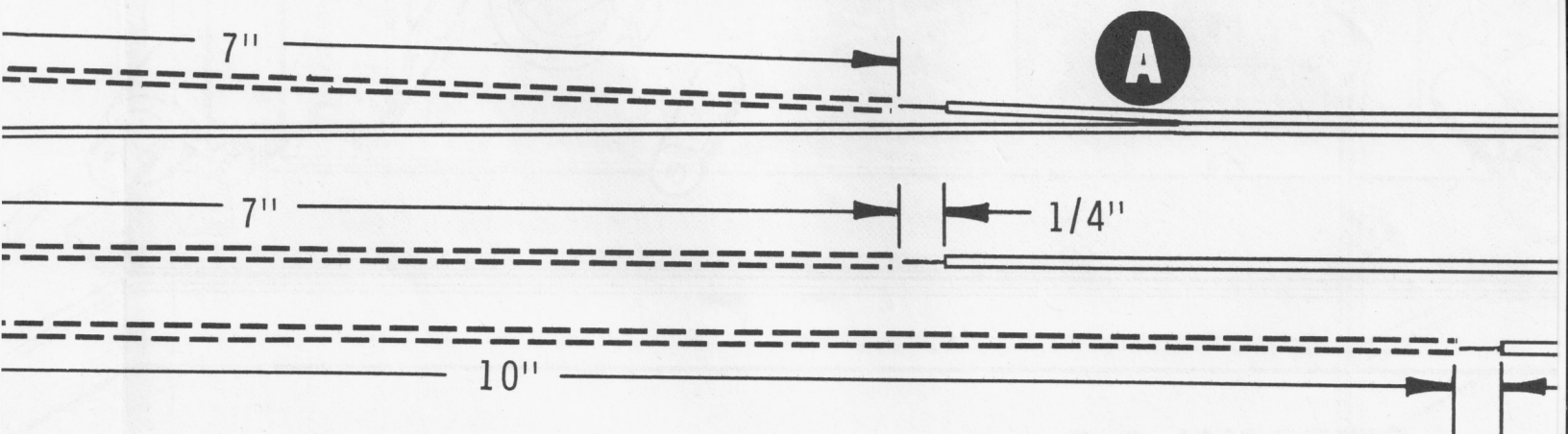


RATE THE WIRES AS SHOWN



SET THESE ASIDE

T THE WIRES TO THE INDICATED LENGTHS AND
MOVE 1/4" OF INSULATION FROM THE WIRE ENDS.



Detail 3-7A

15" LENGTH OF
8-WIRE CABLE

1-1/2"

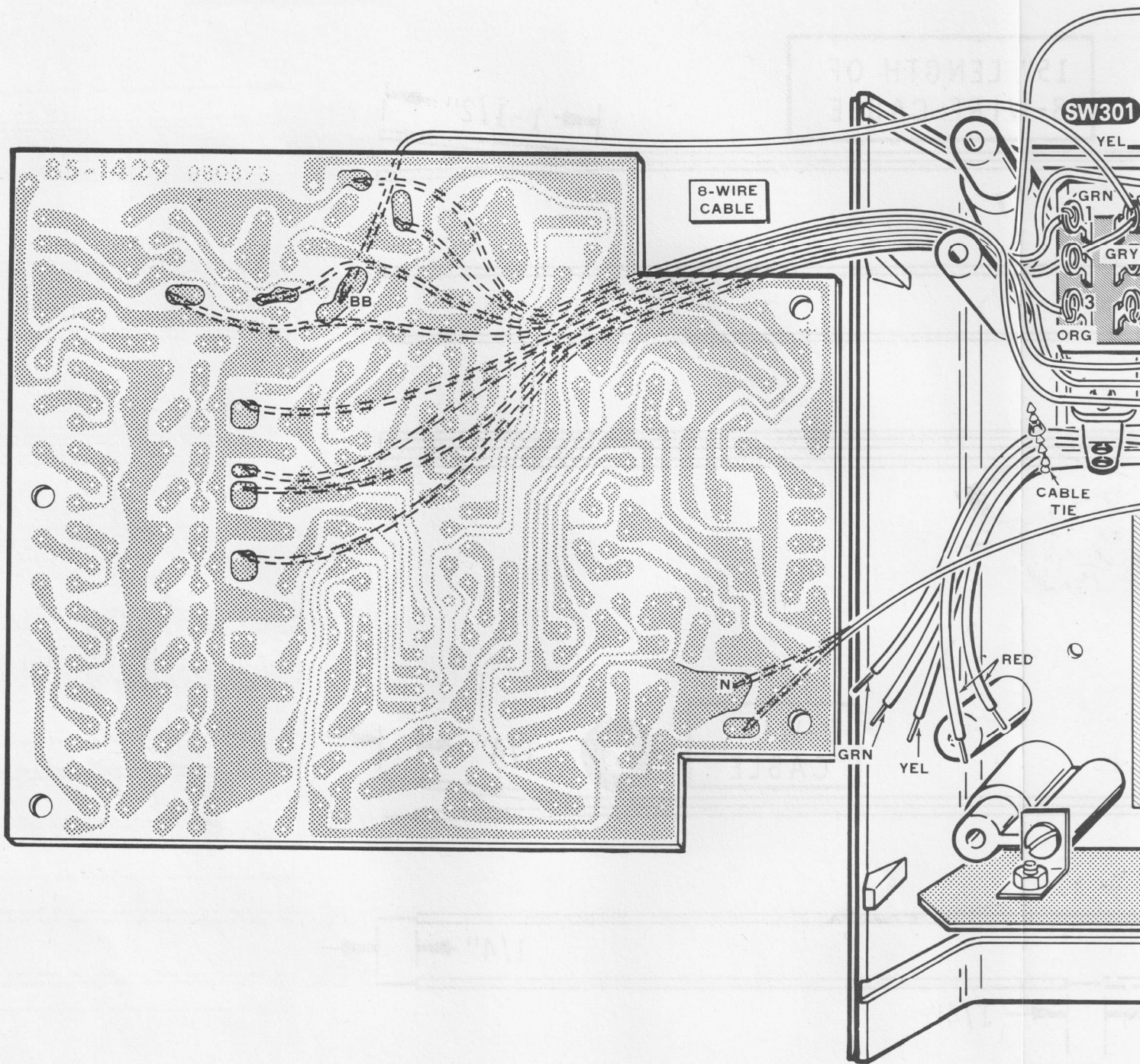
2-WIRE
CABLE

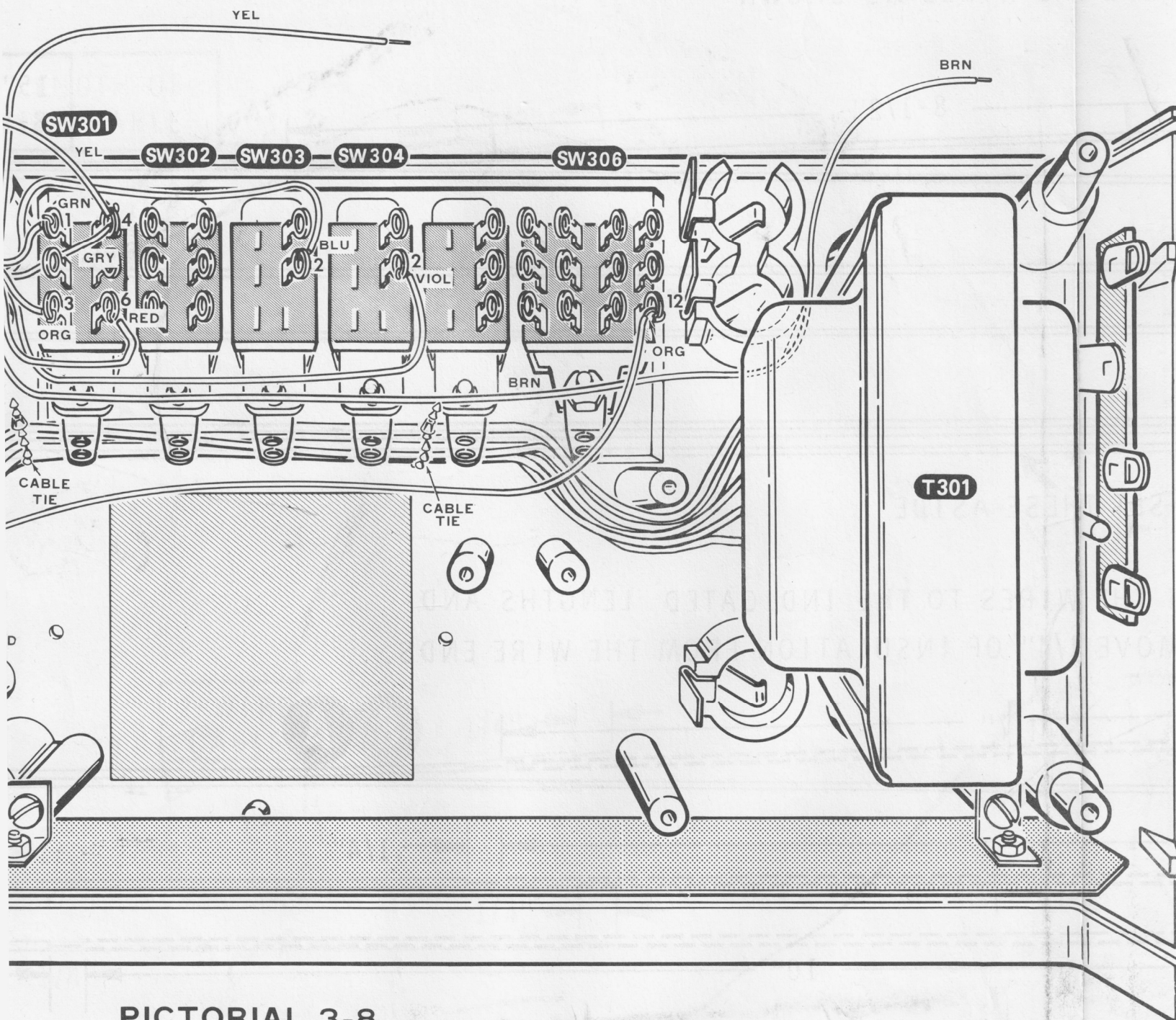
B

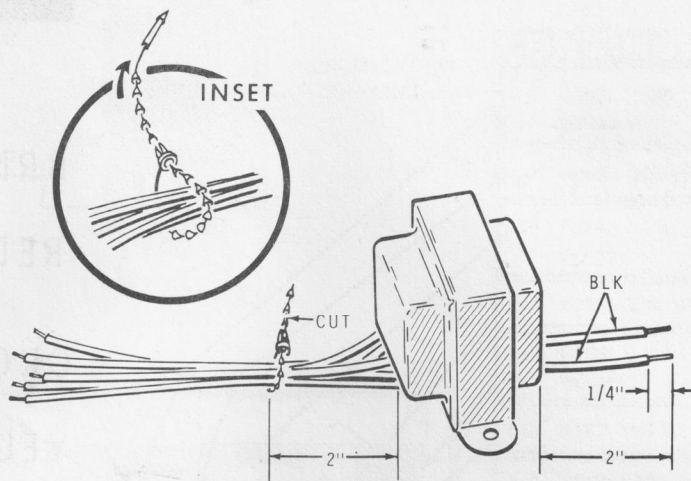
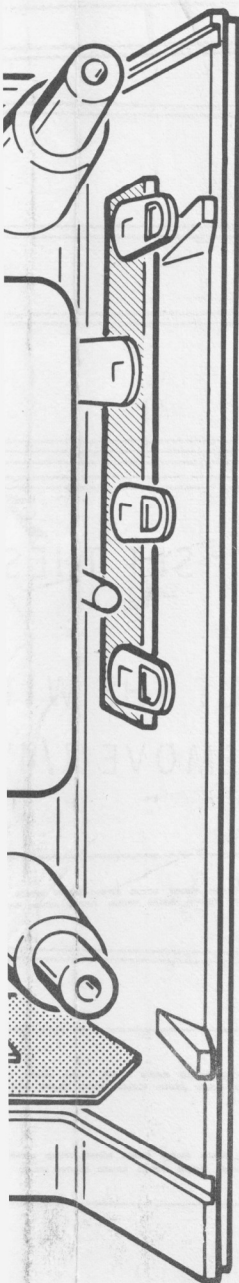
1/4"

1/4"

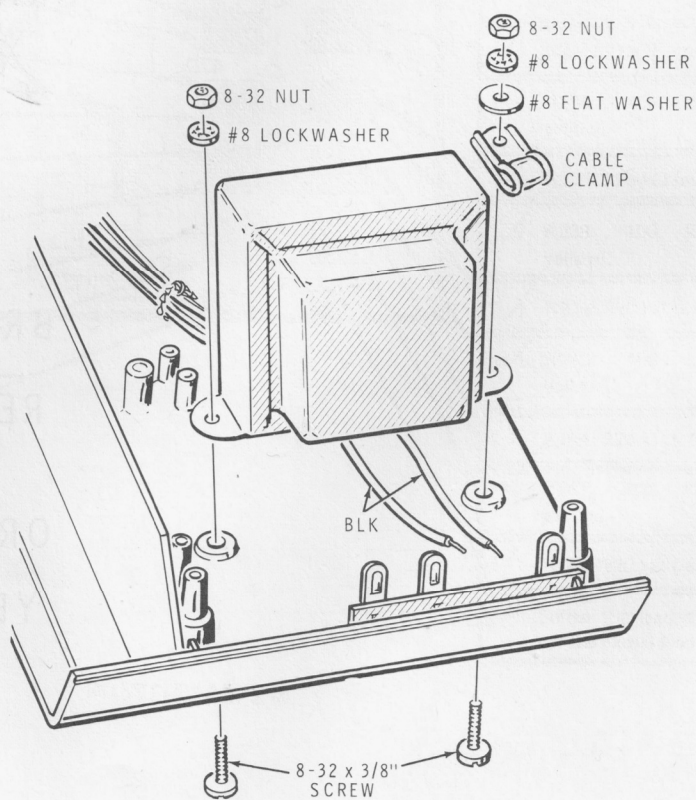
1/4"







Detail 3-8A



Detail 3-8B

Refer to Pictorial 3-8 (fold-out from Page 40) for the following steps.

(✓) Refer to Detail 3-8A, and cut the two black transformer leads to 2", and prepare the ends.

(✓) Prepare the ends of the remaining transformer leads if this is not already done.

(✓) Refer to Detail 3-8A (see the inset drawing) and install a cable tie on the red, green, and yellow transformer leads as shown.

(✓) T301: Refer to Detail 3-8B and mount the transformer. Route the leads as shown in the Pictorial. Use two 8-32 x 3/8" screws, two #8 lockwashers, a #8 flat washer, a cable clamp, and two 8-32 nuts.

(✓) Install another cable tie near SW301 as shown in Pictorial 3-8.

(✓) Bend the six solder lugs down over the transformer leads.

(✓) Connect one end of the previously prepared orange wire to switch SW306 lug 12 (S-1).

In the next step, you will connect the free end of the orange wire to either hole N or hole C in the main circuit board. If you intend to use nickel-cadmium batteries in your kit, use hole N. However, if you intend to use any other kind of batteries (the kind sold in most stores), use hole C.

(✓) Orange wire to hole N or hole C (S-1).

(✓) Connect the previously prepared yellow wire from switch SW301 lug 4 (NS) to the main circuit board hole BB (S-1).

In the following steps you will connect the free end of the remaining 8-wire cable coming from main circuit board holes BA through BJ. Connect the cable wires as follows:

(✓) Green to SW301 lug 1 (S-2).

(✓) Gray to SW301 lug 4 (S-3).

(✓) Violet to SW304 lug 2 (S-1).

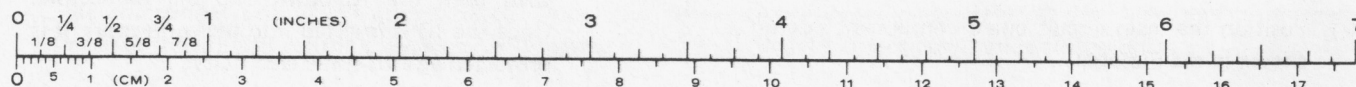
(✓) Blue to SW303 lug 2 (S-1).

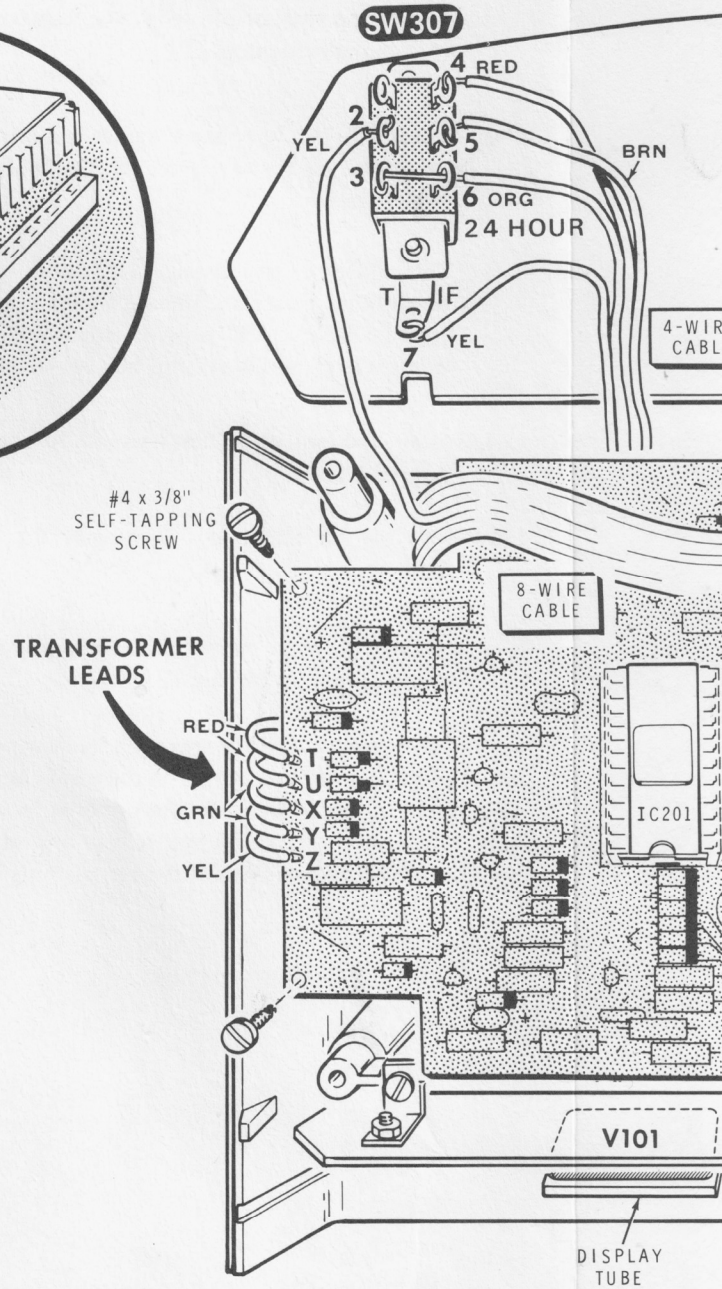
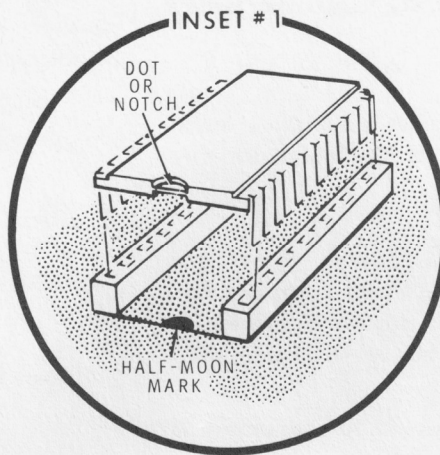
(✓) Yellow. This wire will be connected later. Route it as shown.

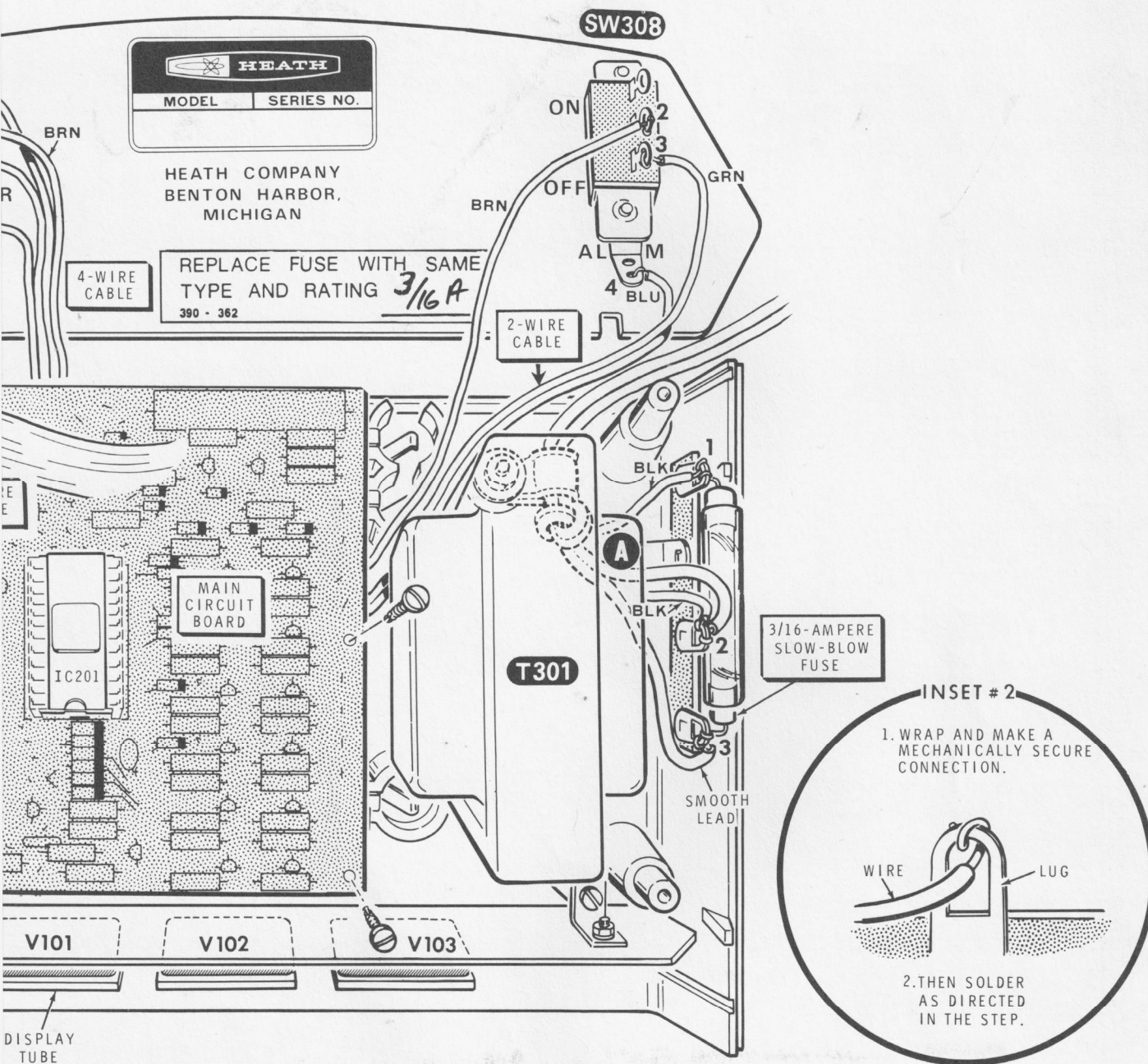
(✓) Orange to SW301 lug 3 (S-1).

(✓) Red to SW301 lug 6 (S-1).

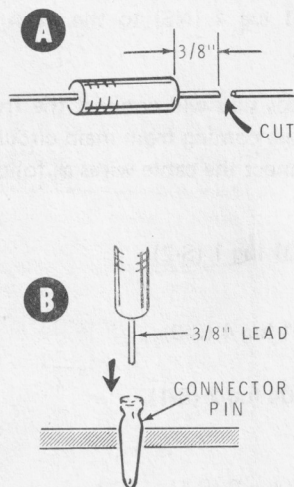
(✓) Brown. This wire will be connected later. Route it as shown.



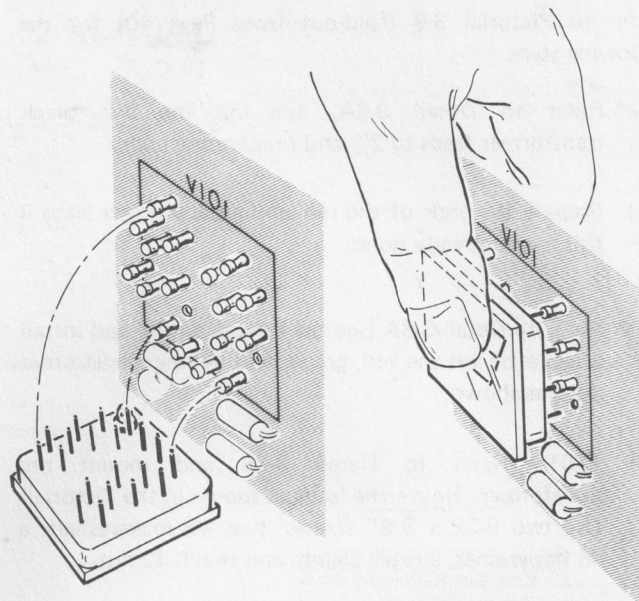




PICTORIAL 3-9



Detail 3-9A



Detail 3-9B

Refer to Pictorial 3-9 (fold-out from this page) for the following steps.

- (✓) Refer to Detail 3-9A and cut one lead of the 10 MΩ (brown-black-blue), 1/4-watt resistor to 3/8". See part A of the Detail. Then push this 3/8" lead into each connector pin V101, V102, and V103 as shown in part B of the Detail. This will open the connector pins slightly and make it easier to install the display tubes.

NOTE: Examine the pins of the display tubes to be sure they are straight before you install the tubes on the readout circuit board, in the following steps. Then, as you install each tube:

- A. Support the rear of the readout circuit board as shown in Detail 3-9B so you do not break it.
- B. Make sure each pin that goes into a connector is actually in that connector. NOTE: Not all pins go into connectors.

- (✓) V101: Refer to Detail 3-9B and install a display tube at V101.
- (✓) V102, V103: Likewise install display tubes at V102 and V103.
- (✓) Position the main circuit board component side up as shown in the Pictorial.

NOTE: The MOS integrated circuit (IC) that you will install in the next step is a rugged and reliable component. However, if normal static electricity is discharged from your body through an integrated circuit pin to another object, such as the Clock, it can damage the integrated circuit. Therefore, read the entire next step and then carefully perform it without interruption. (The material the IC is mounted in will neutralize the static electricity in your body with respect to the IC. Any interruption in the following step, after the IC is removed from this material, would give your body an opportunity to develop a new static charge that would damage the IC.)

- (✓) IC201: Install an MK5017BA integrated circuit (#443-637) in the connector strips as follows:
 1. Remove the IC from its package with both hands.
 2. Hold the IC in one hand and straighten any bent pins with the other hand. While you continue to hold the IC, be careful not to touch it to anything.
 3. Refer to inset drawing #1 on Pictorial 3-9 and position the notched or dot end of the IC over the half-moon mark on the circuit board. Carefully start the IC pins into the connectors; then push the IC down into the connectors. Once the IC is inserted into the connectors, it is protected against static electricity.

- (✓) Carefully mount the main circuit board. Use four #4 x 3/8" self-tapping screws. Be sure all cables are neatly routed and do not pinch any wires.

In the following steps you will connect the free ends of the remaining wires and cables to the cabinet back. Connect the 4-wire cable to switch SW307 as follows:

- (✓) Red to lug 4 (S-1).
- (✓) Brown to lug 5 (S-1).
- (✓) Orange. Remove an additional 1/4" of insulation from the wire end. Then pass the bare end through lug 6 to lug 3. Solder the wire at both lugs.
- (✓) Yellow wire to lug 7 (S-1).
- (✓) Connect the free end of the remaining yellow wire (coming from the 8-wire cable connected to holes BA through BJ) to SW307 lug 2 (S-1).
- (✓) Connect the remaining brown wire to SW308 lug 2 (S-1).

Connect the blue and green 2-wire cable to switch SW308 as follows:

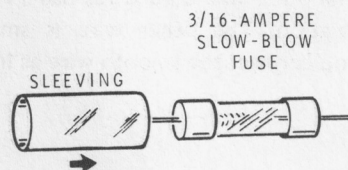
- (✓) Blue wire to lug 4 (S-1).
- (✓) Green wire to lug 3 (S-1).
- (✓) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the cabinet back. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.
- (✓) Locate the fuse label and record the fuse rating on the label (3/16 ampere).

- (✓) Remove the paper backing from the fuse label. Then position the label onto the cabinet back as shown, cover the label with the paper backing, and press the label in place. This will prevent any ink from smearing.

NOTE: When you are told to make a mechanically secure connection, as in the following step, insert the wire through the lug or wrap it around the lug, or both, before soldering. See inset drawing #2 on the Pictorial.

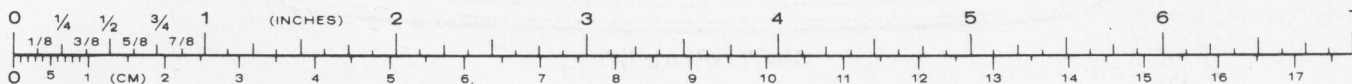
Connect the two black transformer leads to terminal strip A as follows:

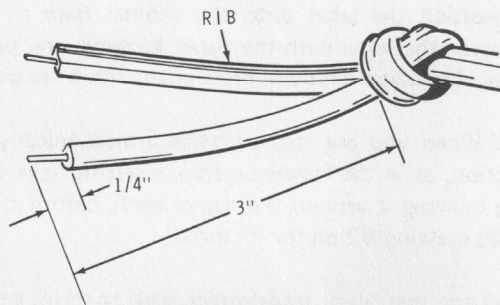
- (✓) Either black lead to lug 1 (NS). Make a mechanically secure connection.



Detail 3-9C

- (✓) Other black lead to lug 2 (NS). Make a mechanically secure connection.
- (✓) Refer to Detail 3-9C and slide the length of large sleeving over the 3/16-ampere slow-blow fuse as shown.
- (✓) F301: Connect the fuse to terminal strip A between lugs 1 (S-2) and 3 (NS). Make mechanically secure connections.
- (✓) Locate the line cord, twist the bare wire ends, and apply a small amount of solder.
- (✓) Route 8" of the end of the line cord through the cable clamp at T301. Temporarily loosen the clamp screw if necessary.



**Detail 3-9D**

- (✓) Refer to Detail 3-9D and prepare the end of the line cord.

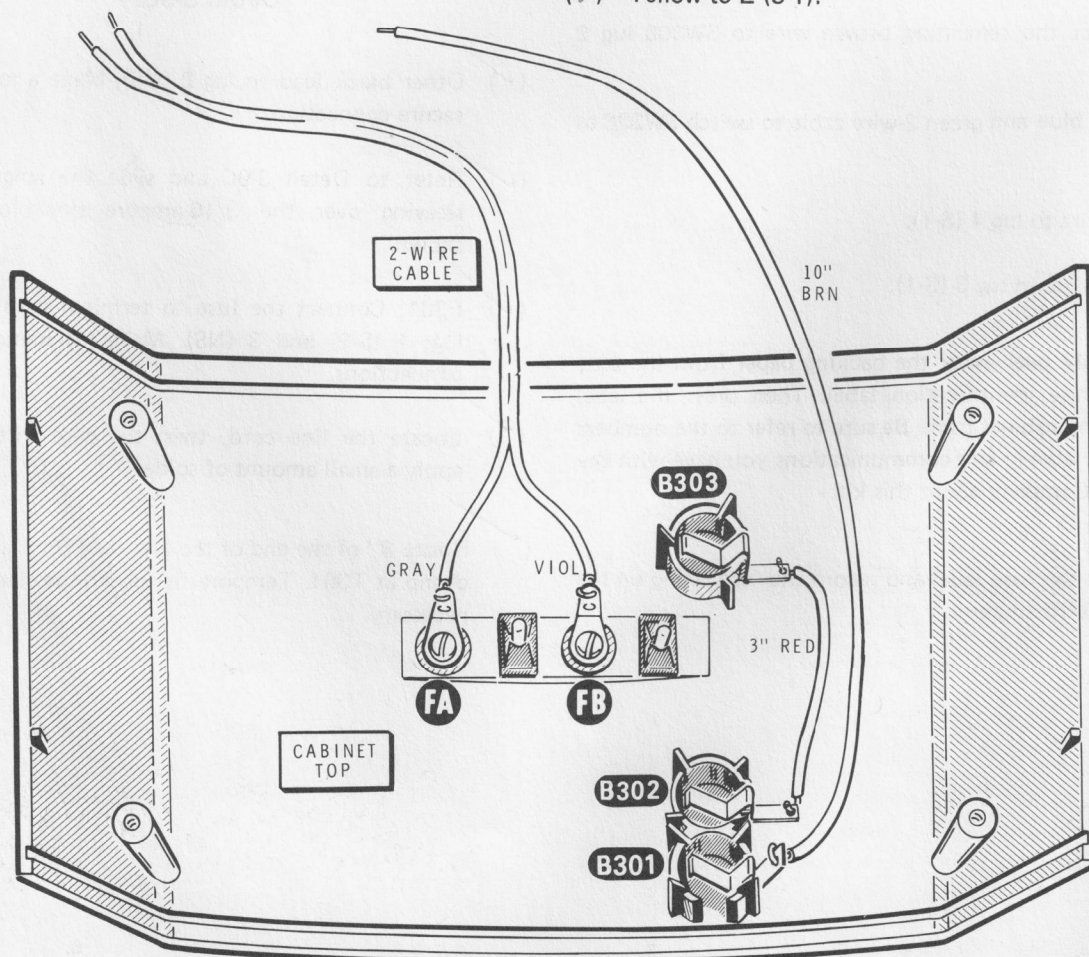
NOTE: One of the outer line cord wires has a rib along the edge of its insulation. The other wire is smooth. It is important that you connect the smooth wire as indicated.

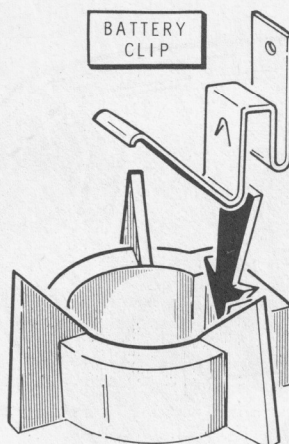
Connect the line cord to terminal strip A as follows:

- (✓) Smooth lead to lug 3 (S-2). Make a mechanically secure connection.
- (✓) Ribbed lead to lug 2 (S-2). Make a mechanically secure connection.
- (✓) Position the line cord wires as shown, so the knot is against the cable clamp.

Connect the five remaining transformer leads to the main circuit board as follows. Solder the leads to the connectors.

- (✓) Either red to T (S-1).
- (✓) Other red to U (S-1).
- (✓) Either green to X (S-1).
- (✓) Other green to Y (S-1).
- (✓) Yellow to Z (S-1).

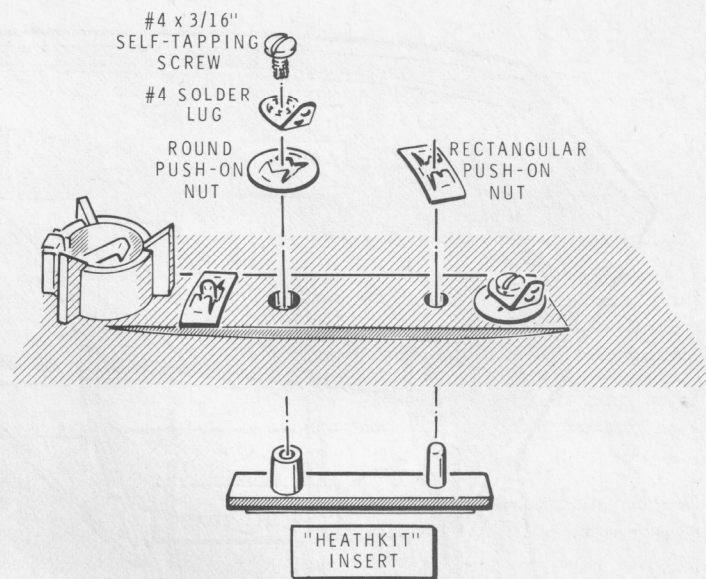
**PICTORIAL 3-10**



Detail 3-10A

Refer to Pictorial 3-10 for the following steps.

- (✓) Refer to Detail 3-10A and install three battery clips in the cabinet top as shown.



Detail 3-10C

- (✓) Refer to Detail 3-10C and install the "Heathkit" insert. Again use rectangular and round push-on nuts, a #4 x 3/16" self-tapping screw, and a #6 solder lug.

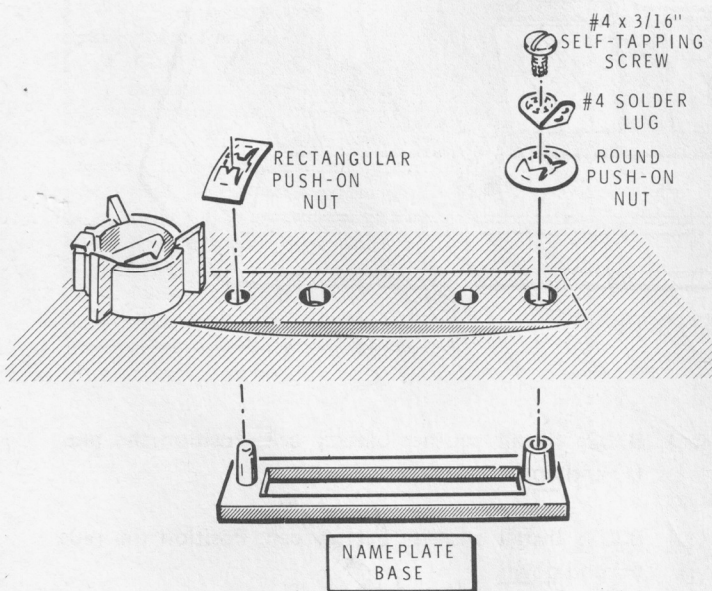
Prepare the following wires.

- (✓) 3" red.
- (✓) 10" brown.

Connect the prepared wires as follows:

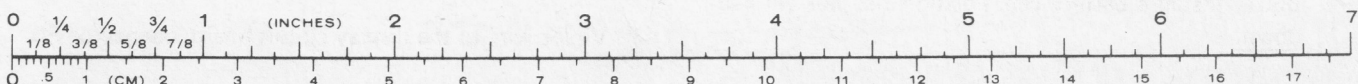
- (✓) 3" red from B303 (S-1) to B302 (S-1).
- (✓) 10" brown to B301 (S-1).
- (✓) Bend the battery clip lugs of B302 and B303 down against the cabinet top as shown in the Pictorial. NOTE: After you install the cabinet top, these battery clip lugs may touch the power transformer. It is alright if they touch or if they do not touch the transformer.
- (✓) Locate the violet and gray 2-wire cable you prepared earlier. Connect the end with the long separated wires as follows:

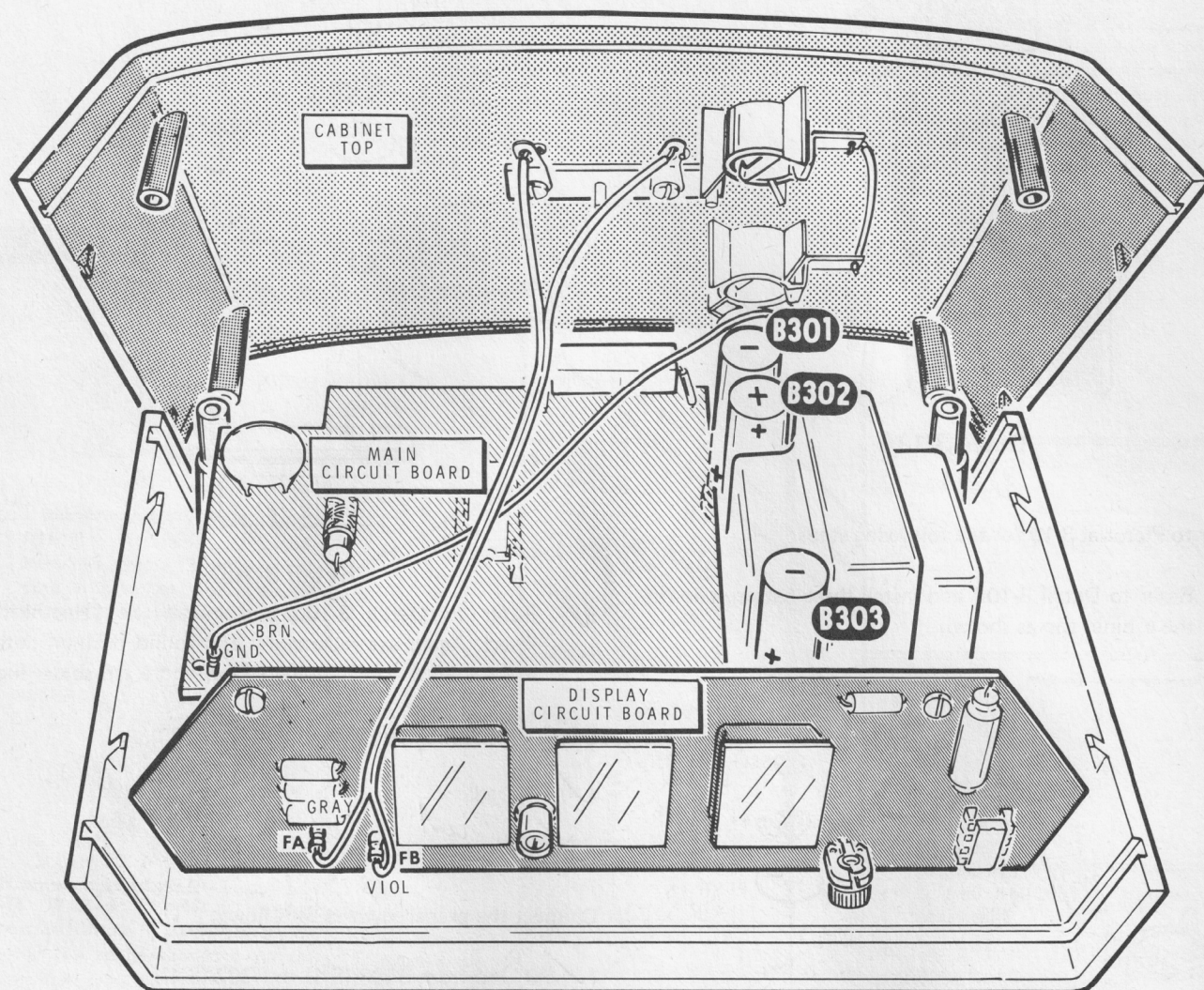
- (✓) Violet to solder lug FB (S-1).
- (✓) Gray to solder lug FA (S-1).



Detail 3-10B

- (✓) Refer to Detail 3-10B and install the nameplate base. Use rectangular and round push-on nuts, a #4 x 3/16" self-tapping screw, and a #6 solder lug as shown.





PICTORIAL 3-11

Refer to Pictorial 3-11 for the following steps.

- (✓) Carefully inspect all connections for loose or poorly soldered wires or leads. Remove any wire clippings or solder splashes.

NOTE: Your Clock will work without batteries when the line cord is plugged into an AC power outlet. However, having batteries in your Clock will allow it to continue to keep time if you unplug the Clock to relocate it or if the AC power fails (due to storms, etc.). If you have purchased batteries (as described on Page 13), install them in the following steps. If you have not yet purchased batteries, ignore the next three steps.

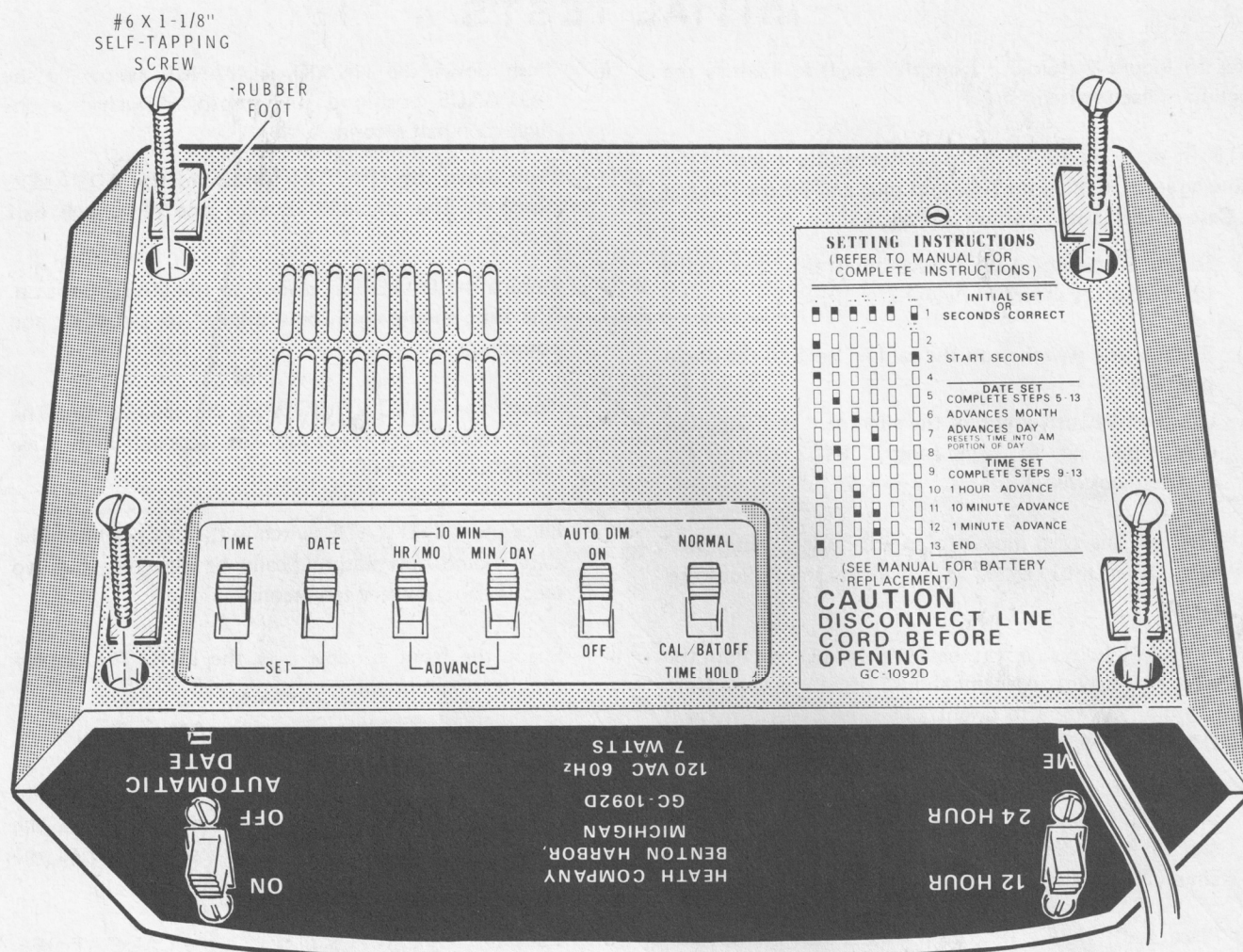
- (✓) B301: Install a battery cell. Position the plus (+) end down.

- (✓) B302: Install another battery cell. Position the plus (+) end up.

- (✓) B303: Install another battery cell. Position the plus (+) end down.

Connect the wires coming from the cabinet top as follows. Do not solder the wires to the connectors.

- (✓) Brown wire to the main circuit board, connector GND.
- (✓) Gray wire to the display circuit board, connector FA.
- (✓) Violet wire to the display circuit board, connector FB.

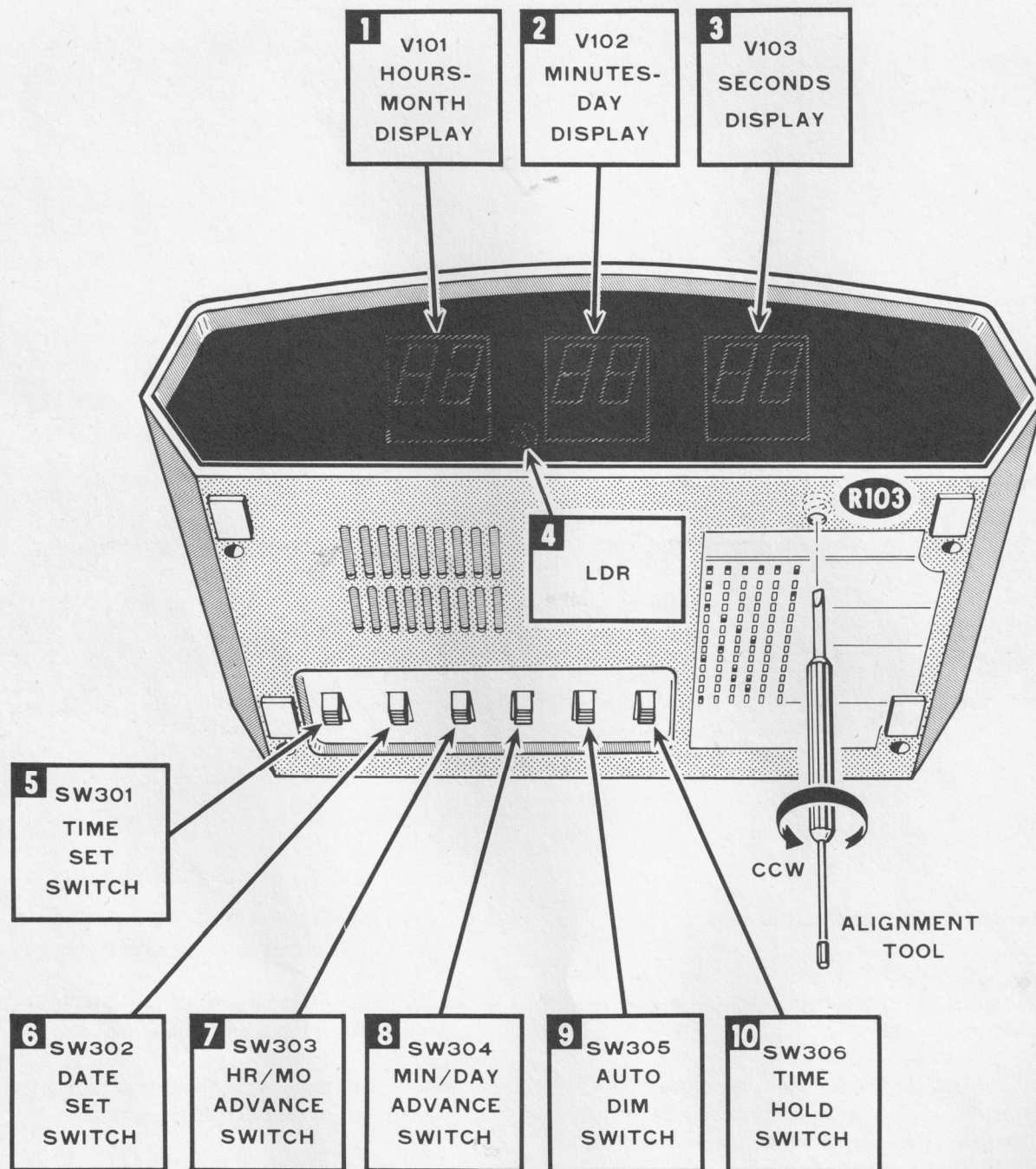


PICTORIAL 3-12

Refer to Pictorial 3-12 for the following steps.

- (✓) Position the window and cabinet back into their cabinet slots. Be sure the line cord fits in its notch and no wires are being pinched.
- (✓) Carefully place the cabinet top into position. Be sure the batteries, cabinet back, and window fit into the top properly. Then secure the top and bottom with four #6 x 1-1/8" self-tapping screws.
- (✓) Locate the set of switch labels. Then remove the "Setting Instructions" section and apply it to the cabinet bottom as shown.
- (✓) Remove the next label (SET, ADVANCE, OFF, etc.) and apply it near the row of switches as shown.
- (✓) Remove the remaining label (TIME, DATE, etc.) and apply it near the row of switches as shown.
- (✓) Remove the paper backing from four rubber feet and install the feet at the four corners as shown.

This completes the "Step-by-Step Assembly." The pedestal base will be mounted later.



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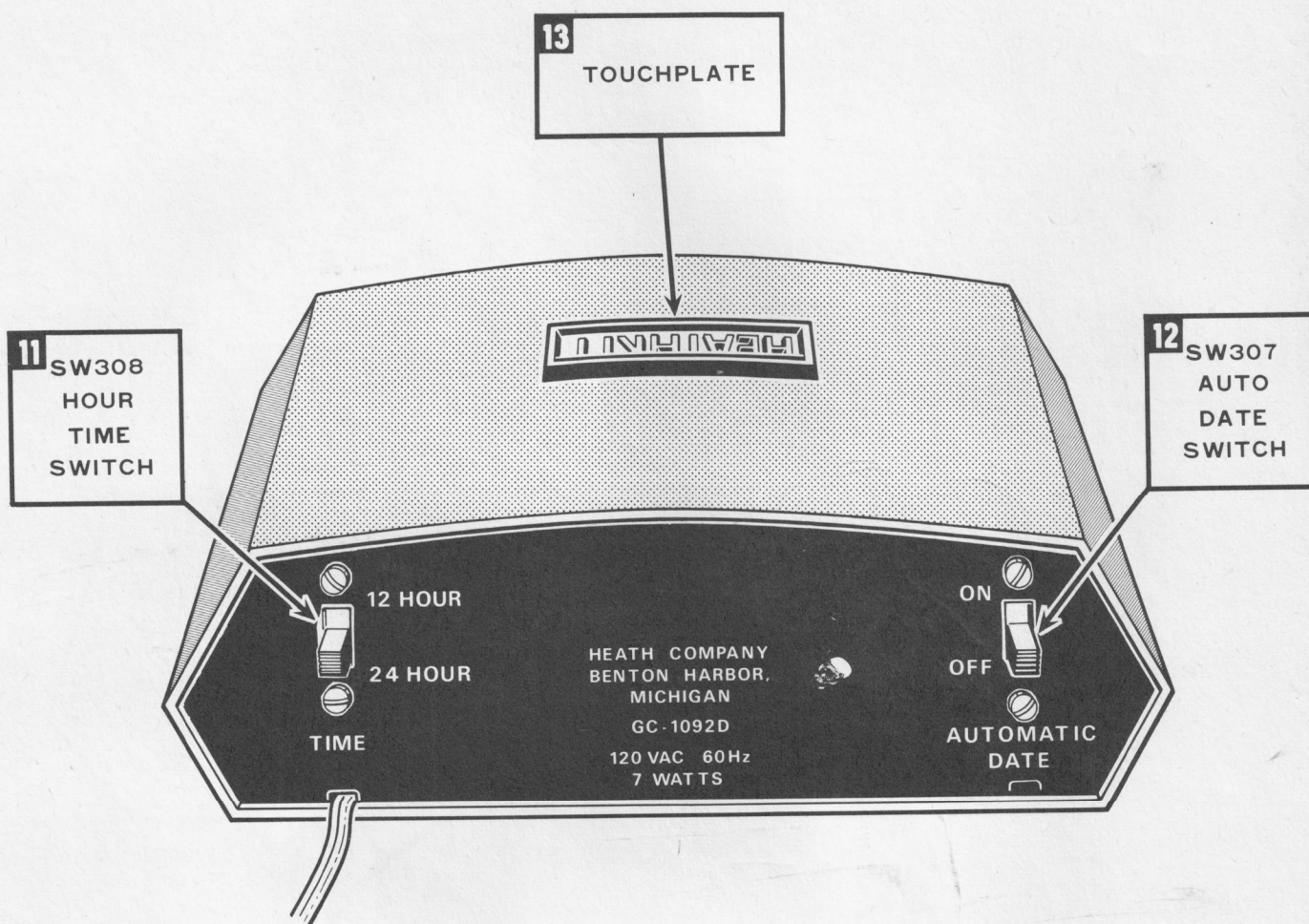


Figure 2

INITIAL TESTS

Refer to Figure 2 (fold-out from this page) to identify the function of each switch.

NOTE: If you do not obtain the proper results in any of the following steps, unplug the line cord plug and proceed to the "In Case of Difficulty" section on Page 51.

(✓) Set the six switches on the bottom of the clock to the up position as shown in Figure 2.

(✓) Set the two switches on the cabinet back to the down position.

(✓) Use the screwdriver end of the alignment tool supplied with your kit to turn control R103 completely counterclockwise.

(✓) Plug the line cord plug into an AC outlet. Within five seconds, each of the six display digits should indicate an 8.

NOTE: When you push down the TIME HOLD switch in the next step, the display intensity should begin changing from bright to dim and back to bright, etc. until you push down the AUTO DIM switch.

(✓) In the order listed, push down the TIME HOLD, AUTO DIM, and TIME SET switches. The display should now indicate 00:00:00 (midnight – 24-hour time).

(✓) Place the HOUR TIME switch into the 12 position. The display should now indicate 12:00:00 (midnight – 12-hour time).

(✓) Return the TIME HOLD switch to its NORMAL position. The SECONDS display will start counting.

(✓) Push down the HR/MO switch to the ADVANCE position. The hours should advance one digit each half second.

(✓) Push down the HR/MO and MIN/DAY switches simultaneously to ADVANCE. The tens of minutes should now advance one digit each half second.

(✓) Push down the MIN/DAY switch to ADVANCE. The minutes should advance one digit each half second.

(✓) Return the TIME SET switch to the TIME position.

(✓) Place the DATE SET switch to the SET position. The display should indicate 1:01 (January 1).

(✓) Push down the HR/MO ADVANCE switch to the ADVANCE position. The month will advance one digit each half second.

(✓) Push down the MIN/DAY switch to the ADVANCE position. The day will advance one digit each half second.

(✓) Return the DATE SET switch to the DATE position. The time should again be displayed continuously and counting.

(✓) Touch the TOUCH PLATE on the cabinet top. The date should be displayed for approximately five seconds.

(✓) Place the AUTO DATE switch in the ON position. The date should now automatically be displayed for two seconds out of every ten seconds.

(✓) Shade the front window over the LDR. The display should remain bright.

(✓) Place the AUTO DIM switch in the ON position.

(✓) Again shade the LDR. The display should dim. (NOTE: If you are working in a dimly lit area, the display should have dimmed when you placed the AUTO DIM switch in the ON position.)

(✓) Place the TIME HOLD switch in the CAL/BAT OFF position. The display should stop counting and cycle bright and dim.

(✓) Use the alignment tool to adjust control R103 until the display intensity is constant. (The amount of intensity does not matter as long as it is constant.) NOTE: The AUTO DIM switch must be in the ON position.

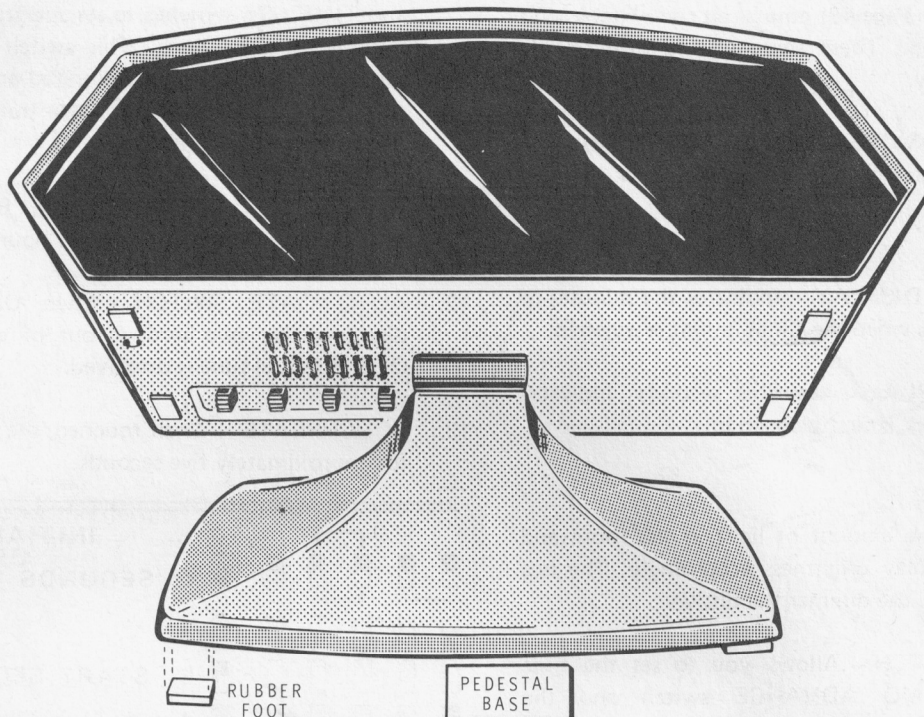
(✓) Return the TIME HOLD switch to the NORMAL position.

NOTE: If you installed batteries in your kit, perform the following step. Otherwise, proceed to "Operation."

() Unplug the line cord plug for a few seconds and then plug it back in again. The Clock should have continued to keep time and the seconds should have continued to count. NOTE: When the Clock is plugged in again, it sometimes displays the date for approximately five seconds.

This completes the "Initial Test."

FINAL ASSEMBLY

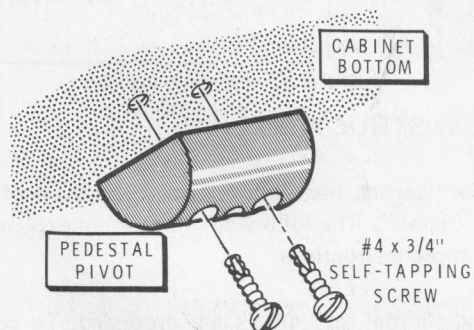


PICTORIAL 4-1

If you want to mount the pedestal base on your Clock perform the following steps. If you intend to use the Clock as it is, without the base, you have finished the assembly of your kit.

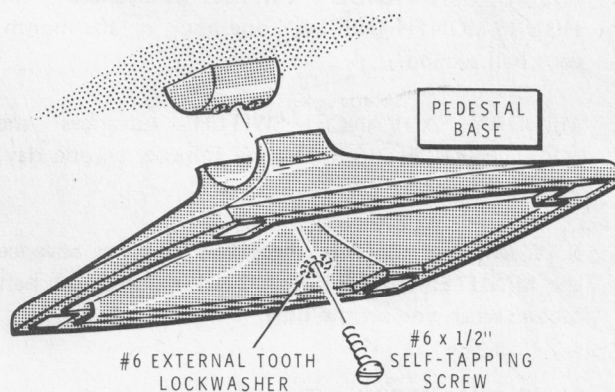
Refer to Pictorial 4-1 for the following steps.

- (✓) Refer to the Pictorial, remove the protective paper backing from a rubber foot, and install the foot on a bottom corner of the pedestal base as shown.
- (✓) Install rubber feet on the three remaining corners of the base.



Detail 4-1A

- (✓) Refer to Detail 4-1A and mount the pedestal pivot to the cabinet bottom. Use two #4 x 3/4" self-tapping screws.



Detail 4-1B

- (✓) Refer to Detail 4-1B and mount the pedestal base to the pedestal pivot. Use a #6 x 1/2" self-tapping screw and a #6 external tooth lockwasher.

This completes the assembly of your Digital Time-Calendar Clock.

OPERATION

Figure 2 (fold-out from Page 48) points out the switches and displays of your Clock. These switches and displays are further described below.

1. **HOURS-MONTHS DISPLAY** — Indicates the hours or the month. Indicates 8's when the Clock is first plugged in.
2. **MINUTES-DAY DISPLAY** — Indicates the minutes or day. Indicates 8's when the Clock is first plugged in.
3. **SECONDS DISPLAY** — Indicates seconds. Indicates 8's when the Clock is first plugged in.
4. **LDR** — Senses the amount of light in the room and controls the display brightness accordingly. The less light in the room, the dimmer the display.
5. **TIME SET SWITCH** — Allows you to set the time using the HR/MO ADVANCE switch and the MIN/DAY ADVANCE switch. NOTE: The TIME HOLD switch must be in the NORMAL position and the SECONDS DISPLAY will be advancing.
6. **DATE SET SWITCH** — Allows you to set the date using the HR/MO ADVANCE switch and the MIN/DAY ADVANCE switch.
7. **HR/MO ADVANCE SWITCH** — Advances the HOURS-MONTH DISPLAY one hour, or one month, each half second.
8. **MIN/DAY ADVANCE SWITCH** — Advances the MINUTES-DAY DISPLAY one minute, or one day, each half second.

7 and 8. When used together, these two switches advance the MINUTES-DAY DISPLAY ten minutes each half second when you set the time.

9. **AUTO DIM SWITCH** — Turns the automatic dimming feature on and off. When OFF, the display should always be bright. When ON, the display will dim as the room's lighting conditions dim.
10. **TIME HOLD SWITCH** — Allows you to start the SECONDS DISPLAY counting at a known time. Then use the HR/MO ADVANCE, MIN/DAY ADVANCE,

and TIME SET switches to set and start the hours and minutes of the Clock. This switch also allows the internal oscillator to be calibrated and it disconnects the batteries so the Clock can be transported and not run down the batteries.

11. **HOUR TIME SWITCH** — Allows the time to be displayed in either 12-hour or 24-hour time.
12. **AUTO DATE SWITCH** — When ON, the date is displayed for two seconds out of every ten. When OFF, only the time is displayed.
13. **TOUCHPLATE** — When touched, the date is displayed for approximately five seconds.

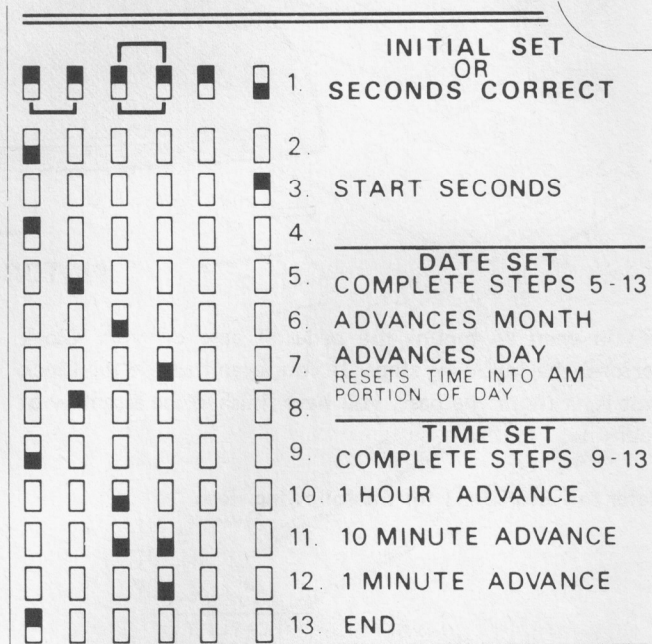


Figure 3

SETTING INSTRUCTIONS

Refer to the "Setting Instructions" on the bottom of your Clock or in Figure 3. The following information explains the 13 steps of those instructions.

1. During "initial set" all 8's are produced. To correct the SECONDS DISPLAY at any other time, position the TIME HOLD switch as shown. The SECONDS DISPLAY will stop. (The display may dim.)
2. During initial set, this switch setting will change the time display to midnight (00:00:00 on 24-hour time, or 12:00:00 on 12-hour time). At other times it allows the time to be set with the other switches.

3. Start the SECONDS DISPLAY at a known time. Watch another clock, or listen to a time reference signal, etc.
4. Return the TIME SET switch to its normal position.
5. Prepares the date to be set.
6. Advances the month.
7. Advances the day. Once this switch is used, the time is automatically changed to the AM portion of the day. (To set the clock to the PM portion of the day, also perform steps 9, 10, and 13.)
8. Return the DATE SET switch to its normal position.
9. Allows the time to be set with the other switches.
- 10, 11, and 12. Push the switches as necessary to advance the hours, tens of minutes, and minutes.
13. Return the TIME SET switch to its normal position.

If you only want to set the time, perform steps 9 through 13. If you only want to set the date, perform steps 5 through 8. NOTE: If you perform step 7, the time will automatically be changed to the AM portion of the day. If this is undesirable, then you must also perform steps 9, 10, and 13.

IN CASE OF DIFFICULTY

This section of the Manual is divided into two parts. The first part, titled "General Troubleshooting Information," describes what to do about the difficulties that may occur right after your Clock is assembled.

The second part, titled "Troubleshooting Chart," is provided to assist you in servicing the Clock if the "General Troubleshooting Information" fails to clear up the problem, or if difficulties occur after your Clock has been in use for some time. The "Troubleshooting Chart" lists a number of possible difficulties that could arise along with several possible solutions to those difficulties.

Try to analyze the symptoms of any problem you might have before starting any troubleshooting procedure. You can usually accomplish this by trying the various functions of your Clock to determine abnormal operations. A review of the "Operation" section above may help your analysis.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 59 for the physical location of parts on the circuit boards.

GENERAL TROUBLESHOOTING INFORMATION

1. Check all the wires that are connected between the two circuit boards and between the circuit boards and other parts. Trace each wire in colored pencil on the Pictorial as it is checked. Make sure these wires are connected to the proper points and are properly soldered. Someone who is not familiar with the unit may notice something you have consistently overlooked.
2. Be sure each IC is seated properly in its socket.
3. About 90% of the kits that are returned for repair do not function properly because of poor connections and soldering. Therefore, many troubles can be located by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Reheat any doubtful connections.
4. Closely examine each circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, a magnifying glass would be helpful for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "X-Ray Views" on Page 59.
5. Be sure each transistor is in its proper location (correct part number and/or type number). Be sure that each transistor lead is in the right hole and has a good solder connection to the foil.
6. Check each integrated circuit for proper positioning. (Be sure the dot or notched end of the IC is over the half dot printed on the circuit board.)
7. Check each capacitor value. Be sure that a capacitor of correct value is installed at each capacitor location. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.

8. Check each resistor value carefully. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor where a 22 k Ω (red-red-orange) resistor is called for. A resistor that is discolored, or cracked, or shows any sign of bulging would indicate that it is damaged and should be replaced. Since damaged resistors are often the result of some other difficulty (such as faulty wiring), you should try to find out what caused the damage before you replace the part.
9. Be sure the correct diode is installed at each diode location, and that the banded end is positioned correctly.
10. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.

If you still cannot locate and correct the trouble after the above tests are completed, and if a voltmeter is available, check your Clock's voltages against the voltages shown on the Schematic Diagram (fold-out from Page 61).

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

WARNING: Hazardous voltages are exposed in the Clock when the cabinet top is removed and the line cord is plugged into the AC outlet. See "Chassis Photograph" on Page 58.

Troubleshooting Chart

This chart lists the condition and possible cause of several malfunctions. If a particular part or parts are mentioned (Q107 for example) as a possible cause, check that part to see if it was installed and/or wired correctly. It is also possible, on rare occasions, for a part to be defective and require replacement. You may also wish to read the portion of the "Circuit Fundamentals" related to your problem and use the Schematic to trace out the wiring in your kit.

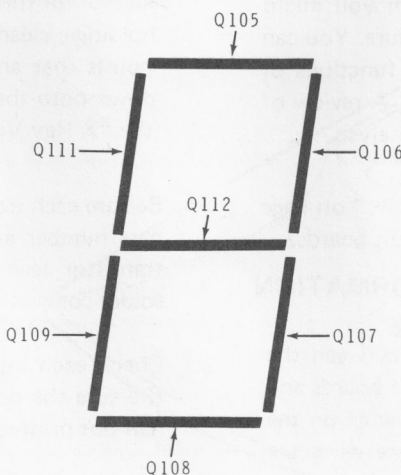


Figure 4

CONDITION	POSSIBLE CAUSE
A digit or a segment of a digit does not light .	1. Check pins of that display tube.
The same segment of all six digits remains lit or does not turn on.	1. Associated transistor (Q105 through Q112). See Figure 4 on Page 52.
One digit does not light	1. V101B - Q208, Q209, D223. V101A - Q211, Q212, D222. V102B - Q213, Q214, D221. V102A - Q215, Q216, D219. V103B - Q217, Q218, D218. V103A - Q219, Q221, D217. 2. Connections at pins 3 through 8 of IC201. 3. Connections to anodes of associated display tube, V101 through V103.
None of the digits light.	1. Diodes D201, D202, D204, D205, D206, D207, D208, D209, and D216. 2. Fuse F301. 3. Transistors Q103, Q104, Q207. 4. Resistor R217. 5. Capacitor C208. 6. Wiring to T301.
One segment lights much brighter than others.	1. Associated transistor, Q105 through Q112.
Only one digit is turned on or digits turn on one after another at a visual rate.	1. R217. 2. C208. 3. IC201.
Time or date cannot be set or remains all eights.	1. D224, D228. 2. Q206. 3. IC201. 4. SW301, SW302, and SW306.
Fails to display 24-hour time or 12-hour time.	1. Q226. 2. D235. 3. SW308. 4. IC201.
Hours or Months will not advance.	1. D226. 2. IC201. 3. SW303.
Minutes or Days will not advance.	1. D227. 2. IC201. 3. SW304.

CONDITION	POSSIBLE CAUSE
Tens of Minutes will not advance.	1. IC201. 2. Be sure both the HR/MO and MIN/DAY switches are pushed down simultaneously.
Touch Control does not make date appear.	1. Q225, Q222. 2. D231, D234. 3. IC102. 4. SW301.
Date is displayed two seconds out of ten, even though AUTOMATIC DATE switch is off.	1. Q223. 2. D229, D232. 3. SW306, SW302.
Displays are always dim or bright.	1. Q102, Q207, Q103, Q104. 2. SW305, SW306. 3. LDR101.
With R103 counterclockwise and Time Hold switch in CAL position, the displays do not cycle bright and dim.	1. Q101, Q205. 2. IC101. 3. SW306. 4. See immediately preceding condition and possible causes.
Clock goes to all eights when line cord is disconnected and then reconnected.	1. Batteries. 2. Q201, Q202, Q203, Q204. 3. D212 (if batteries other than Ni-cad are used), D213, D214, D215. 4. SW306.
Oscillator will not adjust to slow and stop display brightness pulsations as described in adjustment section.	1. IC101. 2. R101, R102, R103, R104. 3. C101, C105.
Off digits are lighted faintly.	1. D204. 2. R132 through R137.
Off segments are lighted faintly.	1. Pin connections of V101, V102, V103. 2. Shorted foil.
Faintly superimposed numbers stepping across display (ghosting).	1. Q207, Q103, Q104. 2. D217, D218, D219, D221, D222, D223.
Flickering Digits.	1. Pull IC201 and see if Keep-Alive Anodes are lighted. If not: a. D203. b. R138 through R144.
Clock display is rapid and random.	1. Time Set and Date Set switches thrown simultaneously — correct switch positions. 2. SW301, SW302.

SPECIFICATIONS

Display	Six full digits.
Format	12 or 24 hours.
Accuracy with AC Line	Determined by accuracy of power line frequency.
Accuracy with Battery	Depends on the initial calibration, battery discharge curve, and temperature. The Clock will lose or gain less than 30 seconds per hour.
Touch Control	Commands date display for approximately 5 seconds.
Power	7 watts, 120 VAC, 60 Hz.
Battery Life	See chart on Page 13.
Dimensions	8-3/8" wide x 4-7/8" deep x 2-1/2" high, 4" high with pedestal.
Weight	3 lbs.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT FUNDAMENTALS

The following fundamentals will give you a better understanding of the circuit relationships in your Clock and describe how the circuits work together. Refer to the Schematic Diagram (fold-out from Page 61) while you read the following information.

All the time-keeping digital logic is performed inside IC201. The remaining circuitry supplies the DC power, responds to the commands from IC201 to drive the display tubes, controls the display brightness, and uses the battery power to produce a DC supply voltage and a 60 Hz reference signal.

The 60 Hz reference signal, taken from either the low voltage secondary winding of transformer T301 or the internal 60 Hz oscillator - IC101, is applied to pin 23 of IC201. The time information is then multiplexed to the six digits of the display. Transistor Q206 shapes the 60 Hz sine wave into a square wave, and R217 and C208 are the timing components for the multiplexing oscillator inside IC201.

The oscillator inside IC201 applies a positive driving pulse to first pin 3, then pin 4, then pin 5, etc. (through pin 8), in rapid succession. This multiplexing action switches on high voltage to each of the six digits, one after another. Also, while the high voltage is switched on, pulses at pins 9 through 15 determine which of the seven segments of that digit are turned on. The multiplexing is so fast that the six digits appear to be all on at the same time.

Example: Consider the time 05:43:21.

As a positive pulse appears at pin 3 of IC201, it turns on transistors Q219 and Q221 and places 204 volts at the anode of V103, part A. Positive pulses also appear at pins 13 and 14 of IC201 at this time. These pulses turn on transistors Q106 and Q107 (which act as controlled current sinks) and turn on the b and c segments (see the fold-out from Page 60) of the display tube to display a one. The other digits of V101, V102, and V103 do not light because of insufficient voltage at their anodes.

The positive pulse next appears at pin 4 of IC201, and part B of V103 receives the high anode voltage. At this time pins 9, 11, 12, 14, and 15 of IC201 go high and turn on transistors Q112, Q109, Q108, Q106, and Q105, which activate the segments to display a two. This multiplexing continues through the six digits and then starts over.

Diodes D217, D218, D219, D221, D222, and D223 act as a 6-input OR Gate and provide a pulse train from IC201. The leading edges of these positive pulses trigger the monostable multivibrator (Q207, Q102, and Q103). The pulse width of this monostable is controlled by LDR101, but cannot exceed the width of the pulse from IC201. The output of the monostable turns on Q104, which applies ground to controlled current sink transistors Q105, Q106, Q107, Q108, Q109, Q111, and Q112. The result is that the brightness of the room, detected by LDR101, controls the duty cycle of the monostable, which in turn controls the brightness of the displayed digits.

IC201 uses a scanning technique to sense control switch programming of switches SW301 through SW307 and the touch-controlled monostable, IC102. Using this method, only two pins (pins 22 and 21 respectively) are required to sense the switching matrix commands.

Diodes D224, D226, D227, D228, D229, D231, D232, D233, D234, and D235 isolate the multiplex signals of IC201 and keep them from influencing other switch matrix circuitry.

With the six bottom switches positioned toward the front of the cabinet and the Automatic Date switch on the cabinet back in the off position, time is displayed continuously. This is because Q223 is normally on and pin 6 of IC201 is connected to the pin 21 multiplex input through D228, D229, Q223, D232, SW307 and SW302. When you touch the touch command plate on the top of the cabinet, this triggers the monostable flip-flop, IC102, to go high. This shuts off Q223 and turns on Q222 and Q225, which disconnects pin 6 from pin 21 and places pin 6 at the pin 22 input through Q222, SW301, and SW302. It also connects pin 8 to pin 21 input through SW301, Q225, SW307, and SW302. This results in the date being displayed for the on time of IC102, which is about 5 seconds. When IC102 returns to its normal state, time is again displayed continuously.

In the Off position, SW305 (Auto Dim) places R109 in parallel with LDR101. This produces a continuously bright display. In the On position, SW307 (Auto Date) disconnects pin 6 from the pin 21 input, and the date is automatically displayed for two seconds out of ten. The touch control still commands the date and overrides the normal display for approximately five seconds.

Transistor Q226 functions as an AND Gate and allows the output pulses at pin 5 of IC201 to be applied to the pin 22 multiplexed input only when pin 19 is high (time is being displayed) and SW308 (Time Hour) is in the 24-hour position. Thus, 24-hour time is displayed.

When SW301 (Time Set) is in the Set position, pin 6 is connected to pin 21 of IC201 through switches SW301 and SW307 (Time hold) — if SW307 is On. However, if SW307 is Off, pins 6 and 21 are connected together through switches SW301, SW307, and SW302 (Date Set). At the same time, the pulses at pin 8 of IC201 are applied to pin 22 through switches SW301 and SW302. With SW301 in the Set position, SW303 (when closed) connects pin 7 to pin 22 to advance the hours, SW304 (when closed) connects pin 7 to pin 21 to advance the minutes, and both SW303 and SW304 (when closed simultaneously) connect pin 7 to pins 21 and 22 to advance the tens of minutes.

NOTE: When SW301 and SW302 are both in the Set position at the same time, an incorrect display may occur.

In the Set position, SW302 (Date Set) connects pin 6 to pin 22, and pin 8 to pin 21. Then, closing SW303 advances the months and closing SW304 advances the days.

Two secondary transformer windings furnish AC voltages to the Clock. Diodes D201 and D202 form the high-voltage full-wave rectifier. Capacitor C201, resistor R201, and zener diodes D204, D205, and D206 filter and regulate this voltage for the neon display tubes. Diodes D207 and D208 form the low-voltage full-wave rectifier. Capacitor C203, resistor R202, and zener diode D209 filter and regulate this voltage for IC201 and the interfacing circuitry. Diode D203 forms a negative high-voltage half-wave rectifier and capacitor C202 filters this voltage which keeps ions in the neon display tubes during inter-digit blanking times.

Resistor R203 and diode D211 provide saturation current through Q201 and a trickle charging current for nickel-cadmium batteries. Diode D212 blocks the trickle charge current if nonrechargeable batteries are used.

Resistors R208 and R209 form a voltage divider which turns on Q204 as long as 120-volt line voltage is present. Transistor Q204 keeps the DC converter circuit shut off by keeping Q202 biased off.

Resistors R212 and R213 form a voltage divider that keeps Q205 biased off. This keeps a voltage from reaching the temporary 60 Hz oscillator, IC101, so that it does not oscillate during normal operation.

OPERATION DURING POWER INTERRUPTION

Transistor Q204 turns off and allows astable flip-flop Q201 and Q202 to oscillate. Current is switched through Q203 and L201 at the frequency necessary to multiply the battery voltage to that required by IC201. Diode D215 acts as a half-wave rectifier and capacitor C207 filters the DC voltage. Diode D216 isolates the voltage from other circuitry to minimize power drain from the battery.

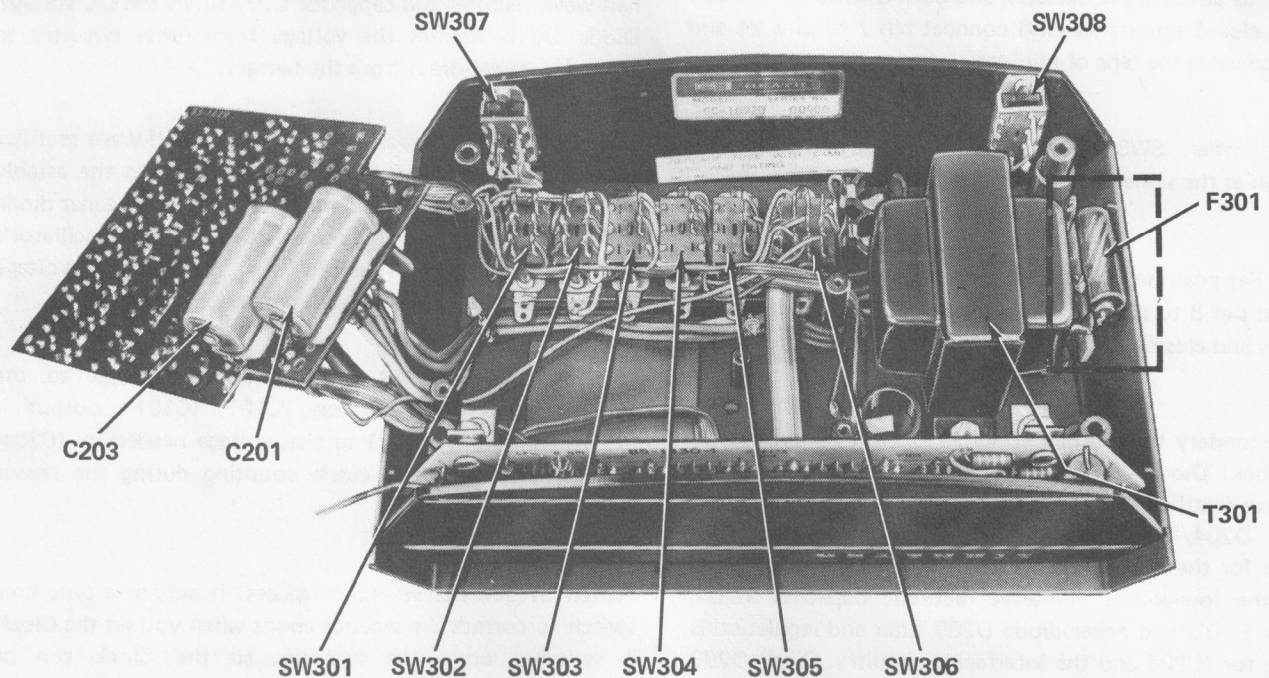
Diode D214 and capacitor C206 form a half-wave rectifier and filter circuit. This voltage is fed back to the astable flip-flop being held at approximately 12 volts by zener diode D213. The feedback adjusts the astable oscillator's frequency to that required for the desired voltage multiplication of this DC-to-DC converter circuit.

Transistor Q205 turns on and applies voltage to the temporary 60 Hz oscillator, IC101. IC101's output is DC-level shifted by Q101 to that voltage needed by IC201. This circuit keeps the clock counting during the power interruption.

Switch SW306 has several purposes. It acts as a time hold switch to correct the seconds count when you set the Clock, it switches open the batteries so the Clock can be transported without discharging them, and it places the Clock into the Calibrate position by applying voltage to the temporary 60 Hz oscillator. In the latter case, both 60 Hz signals are switched together, as Q101 is used to compare their frequency relationship. Q101's output is switched to the now disabled dimming circuit, and the frequency differences appear as display intensity pulses. Control R103 adjusts the temporary 60 Hz oscillator frequency so the intensity pulsations stop.

CHASSIS PHOTOGRAPH

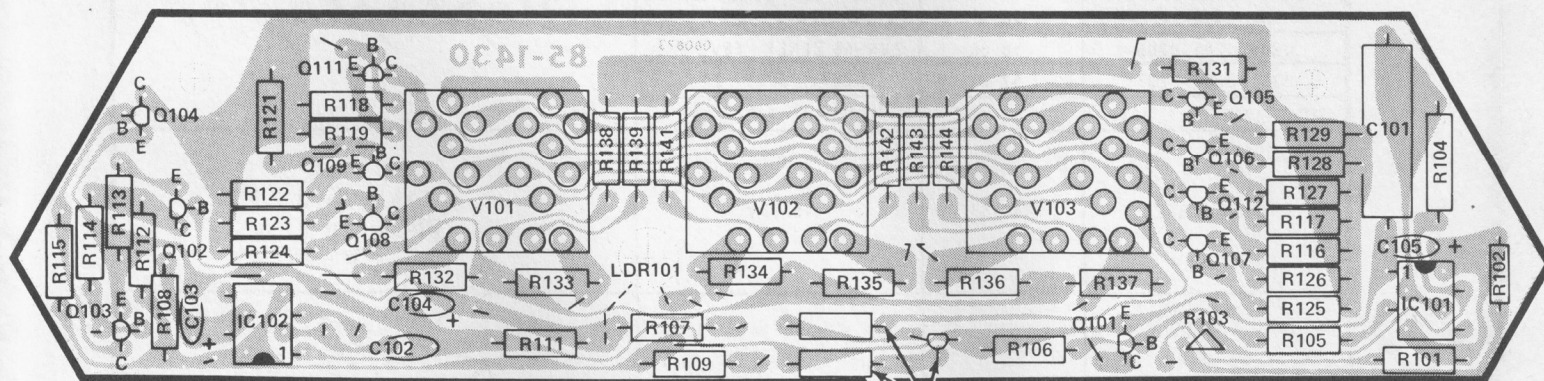
WARNING: Boxed-in area indicates hazardous voltage location.



CIRCUIT BOARD X-RAY VIEWS

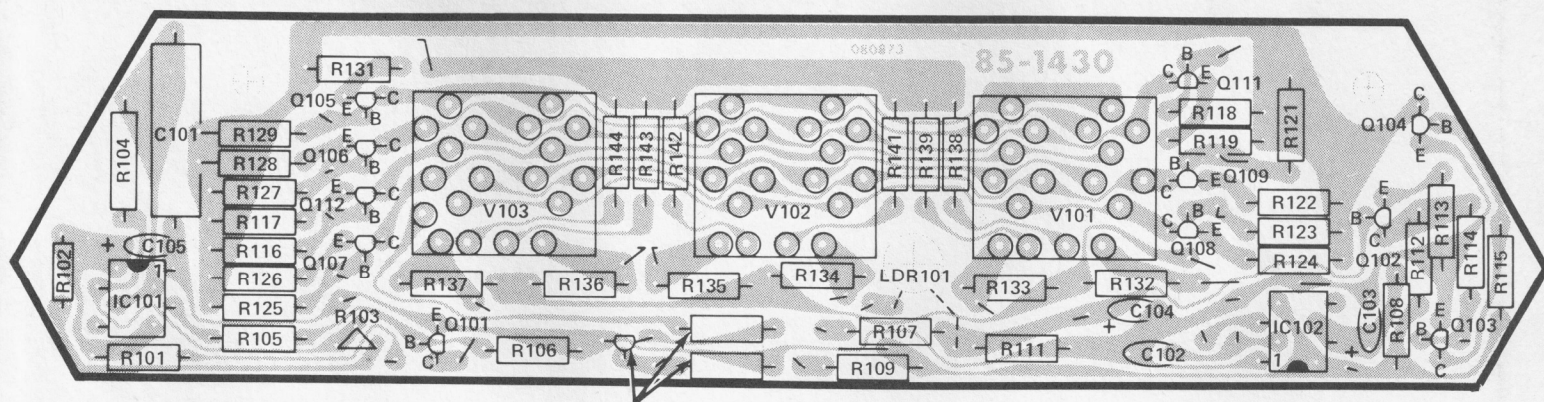
NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- Find the circuit component number (R5, C3, etc.) on the "X-Ray View" or "Chassis Photograph."
- Locate this same number in the "Circuit Component Number" column of the the "Parts List" in the front of this Manual.
- Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



NOT USED

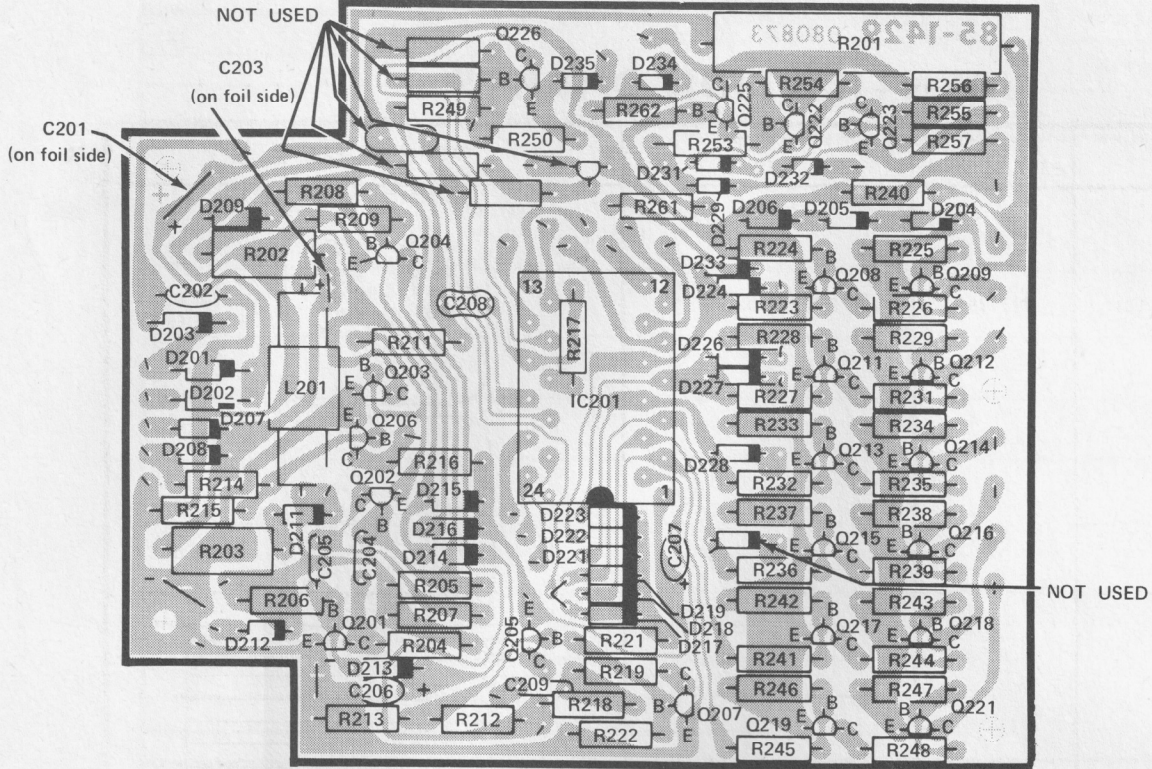
DISPLAY CIRCUIT BOARD
(Shown from component side)



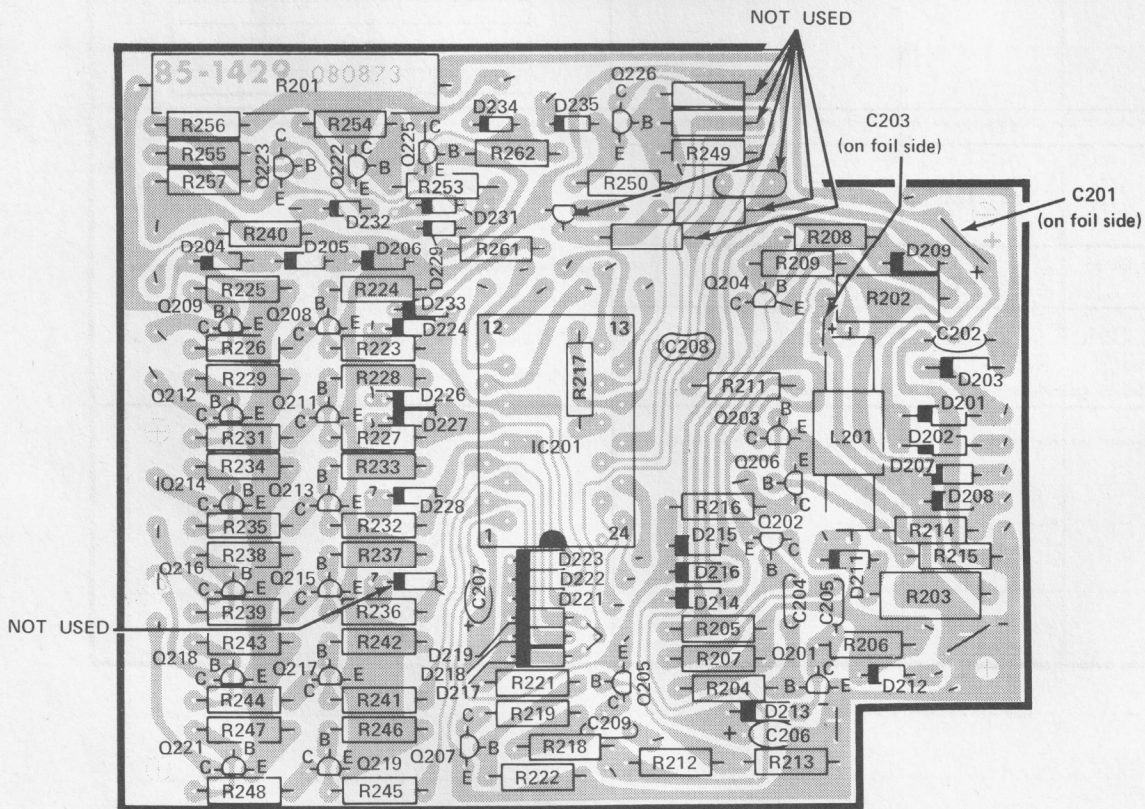
NOT USED

DISPLAY CIRCUIT BOARD
(Shown from foil side)

MAIN CIRCUIT BOARD



(Shown from component side)



(Shown from foil side)

EXP

- (1) Give Part Num
- (2) Include remitt
- (3) Use separate sh
- (4) Prices may cha
- (5) Current HEAT

QTY. PA

THIS FORM IS F

EXP

- (1) Give Part Num
- (2) Include remitt
- (3) Use separate s
- (4) Prices may cha
- (5) Current HEAT

QTY. PA

THIS FORM IS F

EXPEDITED PARTS ORDER FORM

(FOR REPAIR PARTS ONLY)

PLEASE DO NOT WRITE IN THIS SPACE

1) Give Part Numbers as they are in parts list.

2) Include remittance or permission for C.O.D. shipment.

CASH

C.O.D.

3) Use separate sheet of paper for all correspondence.

4) Prices may change to reflect current manufacturing costs.

5) Current HEATH account number

AA

KIT MODEL

DATE OF PURCHASE

SERIES NUMBER

QTY.	PART NUMBER	DESCRIPTION	PRICE	TOTAL PRICE	MARK PROPER SPACE FOR WARRANTY PARTS ONLY		
					3 DAMAGED	2 DEFECTIVE	1 MISSING

HEATH COMPANY

BENTON HARBOR

MICHIGAN ZIP 49022

PHONE 616-983-7381

NAME

ADDRESS

CITY

STATE

HIS FORM IS FOR U.S. CUSTOMERS ONLY. OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR.

CUT ALONG DOTTED LINE

EXPEDITED PARTS ORDER FORM

(FOR REPAIR PARTS ONLY)

PLEASE DO NOT WRITE IN THIS SPACE

1) Give Part Numbers as they are in parts list.

2) Include remittance or permission for C.O.D. shipment.

CASH

C.O.D.

3) Use separate sheet of paper for all correspondence.

4) Prices may change to reflect current manufacturing costs.

5) Current HEATH account number

AA

KIT MODEL

DATE OF PURCHASE

SERIES NUMBER

QTY.	PART NUMBER	DESCRIPTION	PRICE	TOTAL PRICE	MARK PROPER SPACE FOR WARRANTY PARTS ONLY		
					3 DAMAGED	2 DEFECTIVE	1 MISSING

HEATH COMPANY

BENTON HARBOR

MICHIGAN ZIP 49022

PHONE 616-983-7381

NAME

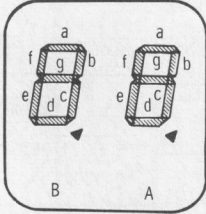
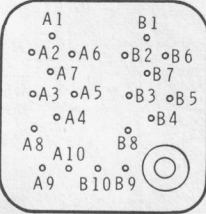
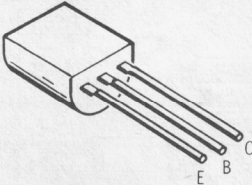
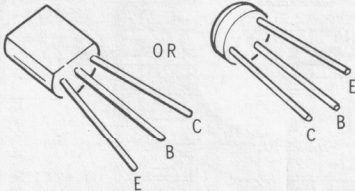
ADDRESS

CITY

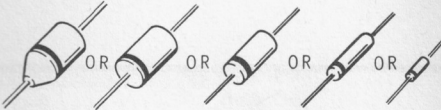
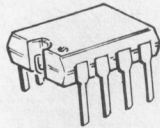
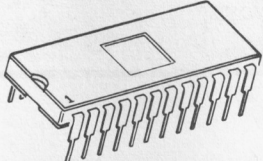
STATE

HIS FORM IS FOR U.S. CUSTOMERS ONLY. OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR.

IDENTIFICATION CHARTS

COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION																						
V101, V102, V103	411-295	SPERRY RAND SP-352	 VIEWED FROM FRONT  VIEWED FROM BACK <table><thead><tr><th>SEGMENT</th><th>PIN NUMBER</th></tr></thead><tbody><tr><td>a</td><td>1</td></tr><tr><td>b</td><td>2</td></tr><tr><td>c</td><td>3</td></tr><tr><td>d</td><td>4</td></tr><tr><td>e</td><td>5</td></tr><tr><td>f</td><td>6</td></tr><tr><td>g</td><td>7</td></tr><tr><td>DECIMAL</td><td>8</td></tr><tr><td>ANODE</td><td>9</td></tr><tr><td>KEEP-ALIVE ELECTRODE</td><td>10</td></tr></tbody></table>	SEGMENT	PIN NUMBER	a	1	b	2	c	3	d	4	e	5	f	6	g	7	DECIMAL	8	ANODE	9	KEEP-ALIVE ELECTRODE	10
SEGMENT	PIN NUMBER																								
a	1																								
b	2																								
c	3																								
d	4																								
e	5																								
f	6																								
g	7																								
DECIMAL	8																								
ANODE	9																								
KEEP-ALIVE ELECTRODE	10																								
Q203	417-233	2N3643																							
Q105, Q106, Q107, Q108, Q109, Q111, Q112, Q208, Q211, Q213, Q215, Q217, Q219	417-294	MPSA42																							
Q209, Q212, Q214, Q216, Q218, Q221	417-295	MPSL51																							
Q101, Q102, Q103, Q104, Q201, Q202, Q204, Q206, Q207, Q222, Q225, Q226	417-801	MPSA20																							
Q205, Q223	417-235	2N4121	 OR																						

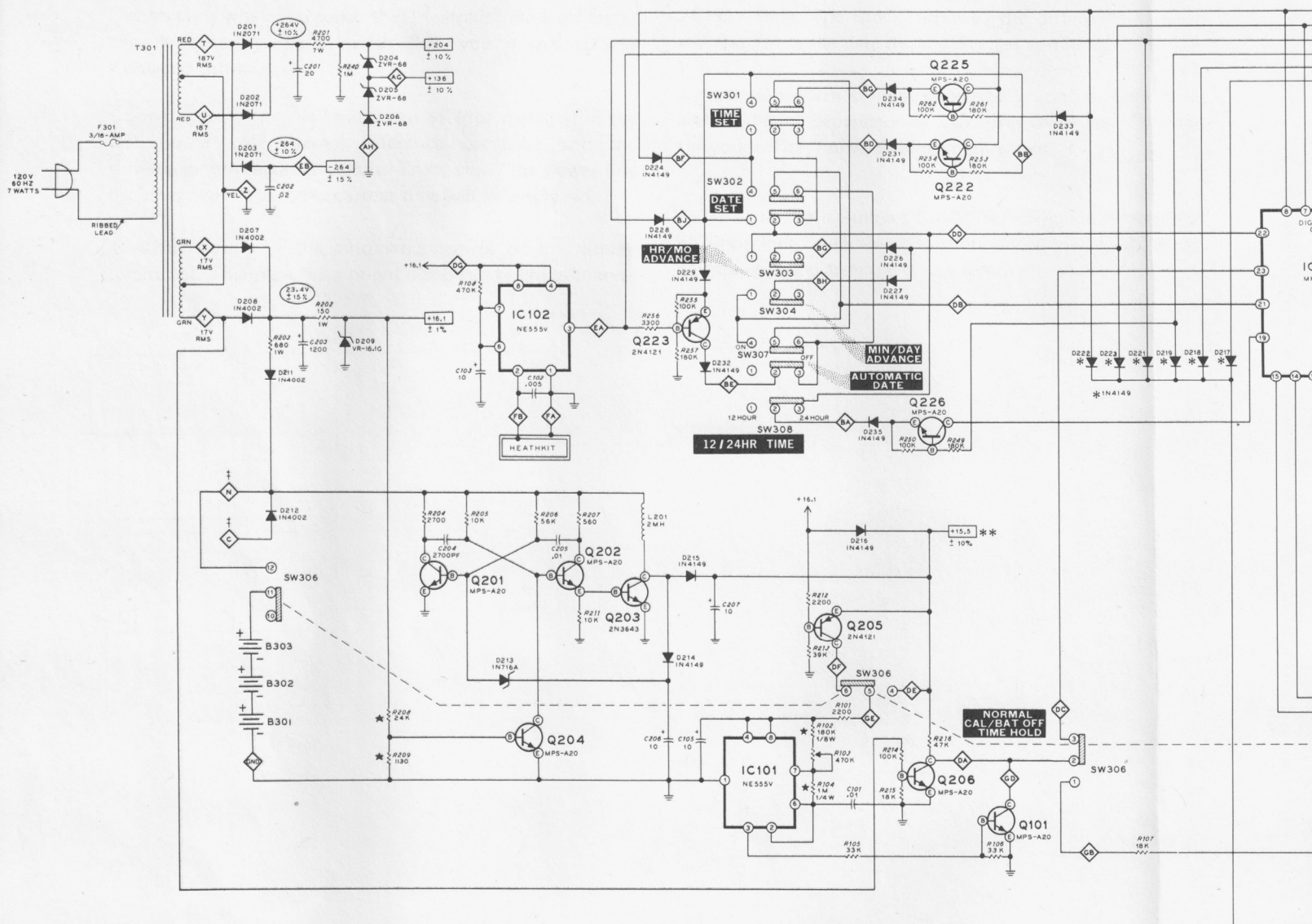
IDENTIFICATION CHART

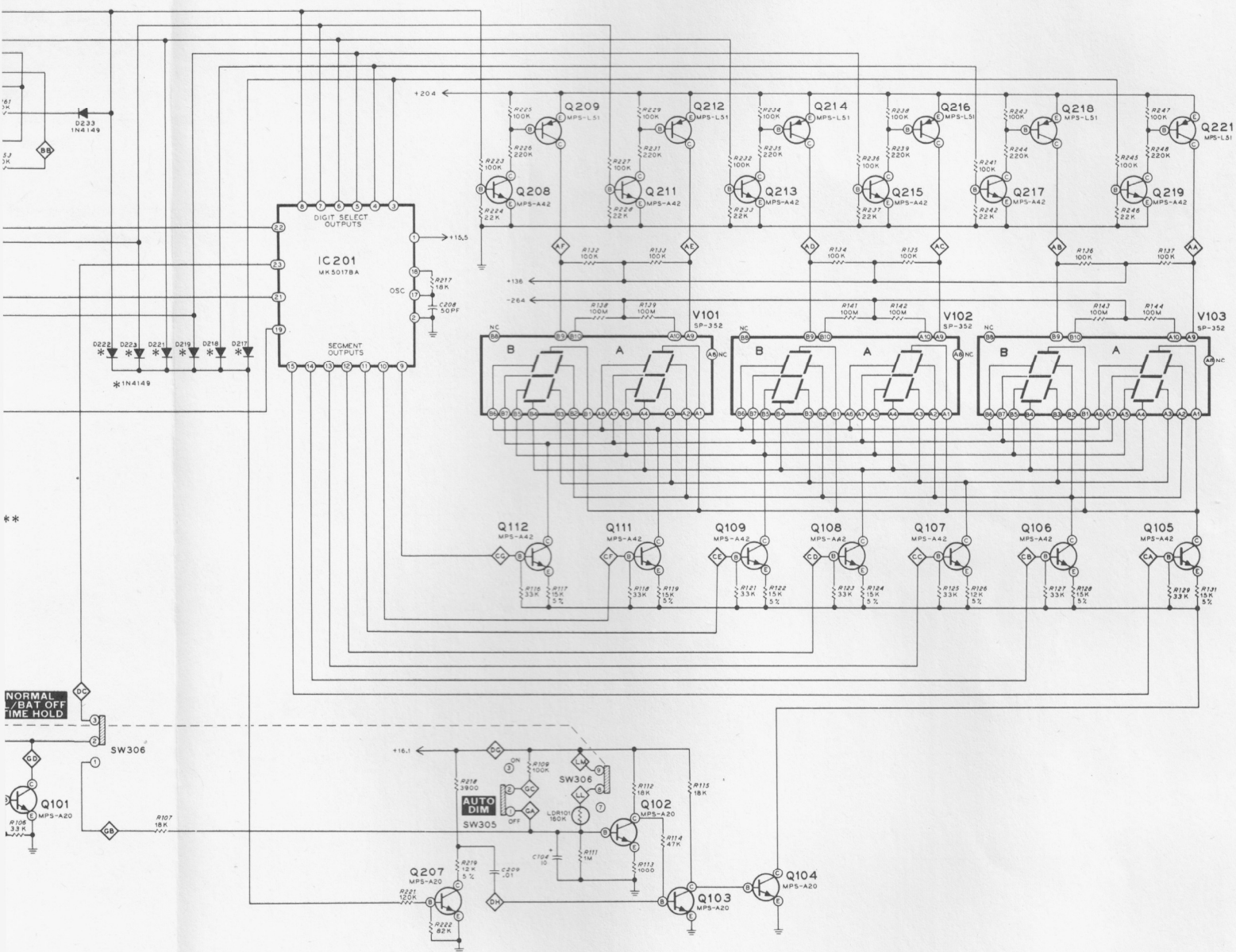
COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D209	56-36	VR-16.1G ZENER, 16.1V, 12mA	NOTE: HEATH PART NUMBERS ARE STAMPED ON MOST DIODES. 
D214, D215, D216, D217, D218, D219, D221, D222, D223, D224, D226, D227, D228, D229, D231, D232, D233, D234, D235	56-56	1N4149, 25V, 10mA	
D213	56-57	1N716A ZENER, 12V, 12mA	
D204, D205, D206	56-68	ZVR-68 ZENER, 68V, 7mA	
D201, D202, D203	57-27	1N2071, 600V, 1A	
D207, D208, D211, D212	57-65	1N4002, 100V, 1A	
IC101, IC102	442-53	NE555V	
IC201	443-637	MK5017BA	

**SCHEMATIC OF THE
HEATHKIT®
DIGITAL
TIME-CALENDAR CLOCK
MODEL GC-1092D**

NOTES:

1. COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:
100-199 PARTS MOUNTED ON THE DISPLAY CIRCUIT BOARD.
200-299 PARTS MOUNTED ON THE MAIN CIRCUIT BOARD.
300-399 PARTS MOUNTED ON THE CHASSIS.
2. ALL RESISTOR VALUES ARE IN OHMS: K=1,000; M=1,000,000.
3. ALL RESISTORS ARE 1/2 WATT, 10% CARBON COMPOSITION UNLESS OTHERWISE INDICATED.
4. ALL CAPACITOR VALUES ARE IN μ F UNLESS MARKED OTHERWISE.
5.  THIS SYMBOL INDICATES CIRCUIT GROUND.
6.  THIS SYMBOL INDICATES A LETTERED CIRCUIT BOARD CONNECTION.
7.  THIS SYMBOL INDICATES A DC VOLTAGE MEASURED WITH A HIGH IMPEDANCE VOLTMETER FROM THE POINT INDICATED TO GROUND. VOLTAGES MAY VARY $\pm 10\%$.
8. ★ THIS SYMBOL INDICATES A METAL FILM, 1% RESISTOR.
9. ** THIS VOLTAGE IS 11.5 VOLTS DURING BATTERY OPERATION.
10. ALL THE SWITCH FRAMES ARE GROUNDED.
11.  WIRING OPTION: USE N FOR NICKEL-CADMIUM BATTERIES, AND C FOR ALL OTHER BATTERIES.
12. ALL BOTTOM SWITCHES SHOWN IN NORMAL (TOWARD FRONT) POSITION; BACK PANEL SWITCHES SHOWN IN DOWN POSITION.







CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- Part number and description as shown in the Parts List.
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your kit? Self-Service? Construction? Operation? Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek. . . please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

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THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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